PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : A01H 1/02, 5/10

A1

(11) International Publication Number: WO 92/01367

(43) International Publication Date: 6 February 1992 (06.02.92)

(21) International Application Number: PCT/US91/04626

(22) International Filing Date: 28 June 1991 (28.06.91)

(30) Priority data:

554.526	19 July 1990 (19.07.90)	US
556,071	23 July 1990 (23.07.90)	US

(71) Applicant: THE LUBRIZOL CORPORATION [US/US]; 29400 Lakeland Boulevard, Wickliffe, OH 44092 (US).

(72) Inventors: ALEXANDER, William, Larry ; 248 Crescent Drive, Breckenridge, MN 56520 (US). JELLUM, Milton, Delbert ; 920 Buck Creed Road, Griffin, GA 30223 (US).

(74) Agents: COLLINS, Forest, L. et al.; The Lubrizol Corporation, 29400 Lakeland Boulevard, Wickliffe, OH 44092 (US).

(81) Designated States: AT (European patent), AU, BE (European patent), BR, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), HU, IT (European patent), JP, LU (European patent), NL (European patent), NO, SE (European patent).

Published

With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: CORN PRODUCTS AND METHODS FOR THEIR PRODUCTION

(57) Abstract

A subgroup of corn varieties and lines comprised of plants that produce seeds having an oleic acid value in the range of 45 % to 57 %. which can be used to produce high oleic corn material predictably, via conventional methods. In particular, corn varieties and lines can be produced, using starting material chosen from the aforementioned subgroup and subjected to cyclic intermating. The high oleic acid progeny are cyclically self-pollinated and selected for a seed oleic acid content of at least 65 % by weight, preferably at least 70 % by weight, and most preferably at least 80 % by weight, or a mean oleic acid content of at least 45 % for commercially acceptable genotypes, or a mean oleic acid content of 55 % for non-commercially acceptable genotypes.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	ES	Spain	MG	Madagascar
AU	Australia	FI	Finland	ML	Mali
BB	Barbados	FR	France	MN	Mongolia
BE	Belgium	GA	Gabon	MR	Mauritania
BF	Burkina Faso	GB	United Kingdom	MW	Malawi
BG	Bulgaria	GN	Guinea	NL	Netherlands
BJ	Benin	GR	Greece	NO	Norway
BR	Brazil	HU	Hungary	PL	Poland
CA	Canada	IT	Italy	RO	Romania
CF	Central African Republic	JP	Japan	SD	Sudan
CG	Congo	KP	Democratic People's Republic of Korea	SE	Sweden
CH	Switzerland			SN	Senegal
CI	Côte d'Ivoire	KR	Republic of Korea	SU+	Soviet Union
CM	Cameroon	LI	Liechtenstein	TD	Chad
CS	Czechoslovakia	LK	Sri Lanka	TG	Togo
DE	Germany	LU	Luxembourg	US	United States of America
DK	Denmark	MC	Monaco		

+ It is not yet known for which States of the former Soviet Union any designation of the Soviet Union has effect.

TITLE OF THE INVENTION

CORN PRODUCTS AND METHODS FOR THEIR PRODUCTION

BACKGROUND OF THE INVENTION

The present invention relates to a corn seed, a corn plant, a corn oil, a corn seed product, a corn variety, a corn hybrid and a method for producing a corn seed. The present invention also relates to the production of corn material characterized by reproducibly high levels of oleic acid in seed, which are (1) at least 65% oleic acid of the total fatty acid composition by weight for one seed, or (2) at least 55% mean oleic acid content for a non-commercially acceptable genotype, or (3) at least 45% mean oleic acid content for a commercially acceptable genotype, as measured by gas-liquid chromatography (GLC).

Corn oil is composed of saturated and unsaturated fatty acids with carbon chain lengths ranging from 12 to 24. Approximately 95% or more of the total oil content is composed of palmitic (16:0), stearic (18:0), oleic (18:1), and linoleic (18:2) acids, Jellum, _J. Agric. Food Chem._, 18:365-70 (1970).

During the past 25 years, inbred lines and hybrids of corn (_Zea mays_ L.) have been documented that display oleic acid compositions varying over a broad range, see, for example, Weber & Alexander, _J.Am.Oil Chem.Soc._ 51:512A (1974). Jellum, _J. Heredity_ 57:243-44 (1966), has documented corn oleic acid values that varied between 22.9% and 45.5% among inbred lines and the progeny of reciprocal crosses thereof. Subsequent testing of a large number of corn introductions from around the world revealed oleic acid content for single kernels ranging from 13.7% to 64.3%. Jellum, _J. Agric. Food Chem._, _supra_.

More recently, six corn inbred lines characterized by different fatty acid contents were used in testing of mean parental, F1, F2, and backcross levels of oleic acid, and a range of 15.1% to 50.3% was documented. Widstrom & Jellum, Crop Sci. 15:44-46 (1975). Generally, F1 and F2 mean values were intermediate to either parental values.

A wide range of oleic acid content has thus been documented for corn, but no value greater than 64.3% has been found. This 64.3% value was obtained for one seed from a single S1 ear from a variable Chilean corn population, see Jellum, J. Agric. Food Chem., supra ("PI No. 303851" in Table III). In Table IV, Jellum also shows an Australian inbred line, designated "CI-7B," which has an oleic acid content of 63.5%. Id. Inquiry in Australia has indicated, however, that germplasm of CI-7B is no longer available to the public.

As to the heritability for oleic acid content in corn, no consistent pattern has been documented in inbreds and in their reciprocal crosses by Jellum, J. Heredity, supra, who attributed the observed phenomenon to a "diversity of gene action for certain fatty acids," including oleic acid. Although reports have appeared from time to time favoring a "single gene" hypothesis for the control of corn oleic acid, see Widstrom & Jellum, supra, and Poneleit & Alexander, Science 147:1585-86 (1965), more recent findings have indicated "a mode of inheritance ... more complicated [than the single-gene hypothesis] ... due primarily to additive gene effects," Weber, Biochem. Genet. 21:1-10 (1983). In de la Roche et al., Crop Sci. 11:856-59 (1971), it is suggested that oleic acid content in corn is under the control of genes at loci in addition to the ln locus, where an oleic content-influencing gene is found. More recently, genes affecting oleic acid content have been localized, in various corn lines, to one or more of chromosomes 1, 4 and 5; Widstrom & Jellum, Crop Sci.

24:1113-15 (1984); Shadley & Weber, <u>Can.J.Genet. Cytol.</u> 22:11-19 (1980).

Accordingly, the published literature on oleic acid content in corn indicates the presence of diverse genes, located on different chromosomes, that affect oleic acid content in a manner not clearly understood. This fact, combined with the virtual absence of information regarding the molecular biology of fatty acid profile in corn, has complicated the task of modifying the oleic acid level in corn and, in particular, has rendered the breeding endeavor of selecting for corn oleic acid content highly unpredictable <u>a priori</u>. Moreover, there has been no basis to date for a reasonable expectation of success in obtaining mean oleic acid levels in excess of 45% for commercially acceptable corn genotypes.

Percentages and ratios given herein are by weight, and temperatures are in degrees Celsius unless otherwise indicated. The references cited within this application are herein incorporated by reference to the extent applicable. Where necessary to better exemplify the invention, percentages and ratios may be cross-combined.

<u>SUMMARY OF THE INVENTION</u>

In general, the present invention relates to corn material having an oleic acid content exceeding the highest values previously reported, and to a corn oil having a percentage of oleic acid that is comparable to that of high oleic canola oil and high oleic sunflower oil.

More specifically, the present invention relates to individual corn seeds which have an oleic acid content of at least 65% by weight relative to the total fatty acid content of the seed (hereinafter expressed as percent by weight, or simply percent). In the most preferred embodiment, the seed has an oleic acid content of greater than 80%. The invention further relates to

a corn plant which produces seeds having a mean oleic acid content of at least 55% by weight. Similarly, the invention relates to a commercially acceptable corn variety having a mean oleic acid content of kernel bulks of at least 45% by weight.

Other features and advantages of the present invention will become apparent from the following detailed description. It should be understood, however, that the detailed description and the specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description. Unless indicated otherwise, respective contents of the documents cited are hereby incorporated by reference.

DEPOSIT INFORMATION

Inbred seeds of *Zea mays* L. strain F_4 of LH85 x 85-205-6 have been placed on deposit with In Vitro International, Inc., Linthicum, Maryland 21090 on July 19, 1990, and have been assigned IVI No. 10254.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In order to provide an understanding of a number of terms used in the specification and claims herein, the following definitions are provided.

"Selection" - Occurs when plants with desired phenotypes or genotypes are chosen for additional plant breeding procedures and breeding projects.

"Intermating" - Is used synonymously with "sibbing" to denote the practice of planting seeds of selected plant phenotypes in individual rows, such that normal germination, emergence and plant maturation occur, and (at the onset of pollen-shed and silk extrusion) systematically crossing plants from each of these rows

to plants from as many other rows as possible, thereby to maximize the number of crosses between unrelated individuals in the population.

"Variety" - Refers to a group of plants within a species, such as *Zea mays* L., which share certain constant characters that separate them from other possible varieties within that species. While possessing at least one distinctive trait, a variety can also be characterized by a substantial amount of variation between individuals within the variety, based primarily on the Mendelian segregation of traits among the progeny of succeeding generations.

"Line" - A line as distinguished from "variety" and "cultivar" refers to a group of plants which are substantially uniform in their traits except that there is relatively minor variation within the group and such variation can be characterized. The decreased variation within this group has generally (although not exclusively) resulted from several generations of self-pollination (selfing).

"True Breeding" - A line is considered "true breeding" for a particular trait if it is genetically homozygous for that trait to the extent that when the variety is self-pollinated, no significant amount of independent segregation of the trait among progeny is observed.

"Significant Variation" - In this regard, significant variation can be adjudged, for example, relative to the variation in oleic value that is attributable to kernel position on an ear, i.e., a variation of between about 4% and 5%. See Jellum, Crop Sci. 7:593-95 (1967). Thus, high oleic corn material of the present invention is that characterized by a variation in single-kernel oleic values of about 5% or less is deemed to be true-breeding for the high oleic trait. As an alternative definition of true breeding for oleic acid content, the variety when self-pollinated will provide progeny

wherein 95% or more of the seeds of the progeny have an oleic acid content above the specified minimum. Thus, an oleic acid content of "at least 65%" will for a true-breeding self-pollinated variety have more than about 95% of the progeny seeds of an oleic acid content of at least 65%. As another example, a corn variety according to the present invention is true-breeding for an oleic acid content of 65% (as opposed to "at least 65%") if, when the variety is self-pollinated, about 95% or more of the progeny corn seeds have an oleic acid content of about 65%, i.e., in about 95% or more of the progeny seeds, there is no significant variation from an oleic acid content of 65%. The relative importance of certain environmental factors (such as planting date, ear position, location and year) and of genetic factors in determining the fatty acid composition of corn oil has been reported by Jellum, <u>Crop Sci.</u> (1967), <u>supra</u>. The results (Table 2) of combined analysis showed that the oil of kernels from the tip of the ear contained less oleic acid and more linoleic acid than did oil from kernels of other positions of the ear. For the inbreds tested in Table 2, the oleic acid content varied by 0.6% to 4.8% as a result of kernel position. The highest oleic acid values generally were obtained from kernels located in the middle or base of the ear, and the lowest oleic acid values resulted from kernels located at the ear tip.

"<u>Oleic Acid Content</u>" and "<u>Oleic Value</u>" - These terms are used synonymously and interchangeably with relation to measurements of the proportion of oleic acid to total fatty acids present in corn oil which is extracted from single seeds (using the whole- or half-seed technique, as described below) or from bulked seed. Since the oleic values set out in this description are generally obtained from GLC analyses, the reported proportions of oleic acid are essentially by weight. When oleic acid content or oleic value are expressed as

a percent or a percent by weight, it is to be understood that such percentage is relative to the total fatty acid content of the seed(s).

"Bulked Seed" - can be constituted, for example, from a plurality of seeds of a single cob (a "kernel bulk"), from the combined seed from all or a particular part of a genetically related family of plants, or from the seed of a plant introduction (defined below).

"Corn Oil" in the present context is a vegetable oil produced via a process comprising the extraction of oil from corn seed, preferably bulked seed constituted from seeds containing oil with a mean oleic acid content in the same general range, say, greater than 50%. In a preferred embodiment, corn oil of the present invention is obtained by a process entailing extraction of oil from a collection of seeds that differ in oleic acid content over a range of no more than about 5% by weight; such a collection is said to be a "substantially homogeneous assemblage" of seeds (defined below).

A "Commercially Acceptable Genotype" is used to refer to any genotype including genotypes of inbreds and hybrids which yield plants having agronomically acceptable traits (such as yield, moisture, rate of dry-down, stalk lodging, vigor, root lodging, disease resistance, insect resistance and the like) such that (A) with respect to inbreds, these traits allow the economical use of this genotype in the production of hybrid seed, or (B) with respect to hybrids, the acceptable traits are present in the hybrid plants when grown in a farmer's field.

A "Plant Introduction" (P.I.) - is a sample of seeds of the same species (e.g., Zea mays L.) that can be grown into plants having a common discernible (gross) morphology. Generally designated by country of origin, a P.I. often represents germplasm native and/or adapted to that country, and hence may embody considerable

genetic variability. A P.I. can also represent the germplasm of an inbred line.

"<u>Homogeneous Assemblage</u>" - The term is intended to refer to a group of seeds which are homogeneous (do not have significant variation) for a given characteristic. One example of a group of seeds would be 2,000 randomly-selected seeds from one acre of corn.

"<u>Mean Oleic Acid Content</u>" - Is the average of oleic acid values obtained for a designated genotype or family of genotypes. The oleic acid values are determined from bulked seed (defined above) of the genotype or from nine or more kernels equally representing the top, middle and base portions of the ear.

A general source for germplasm has been identified, in the form of a specific subgroup of corn varieties and lines comprised, respectively, of plants producing individual seeds that have an oleic value in the range of 45% to 59%, from which high oleic material can be generated predictably in accordance with the description herein. In particular, it has been discovered that corn varieties and lines can be produced using starting material chosen from the aforementioned subgroup and subjected to intermating and selection of the top 1-20% of oleic acid-producing plants, followed by cyclic self-pollination and selection of genotypes (lines) which have a mean oleic acid content of at least 55% by weight, e.g., 58% or 60% by weight, or more. Moreover, the high oleic characters developed thus can be readily introgressed (transferred) into other genetic backgrounds, for example, by backcrossing a high oleic inbred line of the present invention with a recurrent parent having one or more desired agronomic characteristics other than high oleic value. The product of backcrossing to an elite recurrent parent, followed by four to eight selfing generations, is an inbred corn line which is agronomically desirable in addition to having a mean oleic acid percentage of at least 45%.

A high oleic oil produced in this manner would be expected to possess a sterol constituency typifying corn oils *per se*, see Itoh et al., J.Am.Oil Chem.Soc. 50:122-25 (1973), particularly with regard to the 24-methyl-Δ^{23} sterols described by Itoh et al., Phytochem. 20:1353-56 (1981), at least one of which (24-methyl-23-dihydrolophenol) is thought to be unique to corn oil. The high oleic oil of the present invention could be used as a raw material in making other oil products which, although sufficiently modified so as not to be recognizable as "corn oil," would retain a high oleic acid content. Identification of individual oils in mixtures was achieved in an article by Abu-Hadeed, J.Am.Oil Chem.Soc. 65:1922 (1988). Table 1 of this reference shows the differences for specific components between economically important vegetable oils. Table 2 shows the threshold value of the characteristic component of corn oil to be 2.20 mg/g of β-Sitosterol.

Starting materials are known and readily available from the USDA Plant Introduction Station at Iowa State University (Ames, Iowa). P.I.'s from the Ames collection, which embody varieties or lines that are exemplary sources of germplasm to use in the present invention, are listed in Table 1 herein. The varieties and lines represented by such accessions after selfing produce bulked seed from individual ears that, while possibly displaying a variable overall oleic acid content, comprise a significant percentage of individual seeds having oleic values that are about 45% or greater, but typically less than about 55%. However, there were wide variations in oleic acid content between individual ears obtained by selfing the indicated lines. For example, PI 303851 (Chile) produced seeds having an oleic acid content of from 32.93% to 48.49%. The oleic acid content of kernels of selected ears is shown in Table 1.

Table 1. EXEMPLARY SOURCES OF GERMPLASM
Single Seed Oil Samples of
Plant Introductions (S0 ears)

(Ames Collection)

P.I. No.	Origin	Oleic Acid (%)
162573	Argentina	42.04, 44.58, 40.86, 52.75, 39.18
186218	"	45.16, 44.03, 46.29, 47.27, 45.88
180163	Austria	40.54, 40.81, 49.04, 42.74, 43.09
303851	Chile	48.49, 45.52, 44.77, 32.93, 40.53
291391	China	49.50, 43.53, 47.32, 43.18, 44.78
303878	Japan	43.62, 47.09, 42.49, 41.66, 48.32
303889	Japan	39.78, 44.23, 49.26, 40.36, 42.72
181839	Lebanon	48.25, 53.63, 49.49, 61.15, 57.15
209135	Puerto Rico	51.55, 32.79, 40.08, 42.88, 37.38
228182	Russia	50.40, 46.95, 48.89, 45.47, 47.02
236995	Siberia	44.58, 32.53, 42.25, 30.44, 43.86
180230	United Kingdom	46.60, 40.17, 33.46, 44.00, 46.41

Table 1. EXEMPLARY SOURCES OF GERMPLASM (Cont'd)

P.I. No.	Origin	Oleic Acid (%)
218162	USA (Arizona)	36.82, 35.02, 44.33, 43.19, 42.53
213701	USA (Iowa)	46.51, 38.97, 45.35, 40.46, 38.62
217406	USA (Iowa)	48.72, 37.14, 35.61, 42.48, 41.88
217409	USA (Iowa)	50.78, 37.01, 35.94, 40.16, 40.15
218141	USA (New Mex.)	46.58, 44.02, 39.97, 35.05, 37.92
218142	USA (New Mex.)	42.65, 46.45, 40.33, 49.84, 34.53
213796	USA (N. Dak.)	40.27, 48.19, 41.41, 41.86, 39.86
245130	USA (Rd. Island)	41.68, 44.89, 43.53, 40.54, 40.28
317680	USA (S. Dakota)	43.20, 44.27, 40.50, 44.01, 44.89

Other sources for publicly-available corn germplasm include the U.S. Department of Agriculture's National Seed Storage Laboratory (Colorado State University, Fort Collins, Colorado) and Centro Internacional de Mejoramiento de Maiz y Trigo (International Center of Corn and Wheat Improvement), Londres 40, Apertado Postal 6-641, 06600 Mexico, D.F., Mexico.

In accordance with the present invention, bulk seed of a suitable starting variety or line is screened to identify those seeds having an oleic acid content of at least about 45%. The screening can be effected, for example, by a half-seed technique, in which the seed scutulum is excised and the oil extracted is assayed by GLC, see Jellum & Worthington, <u>Crop Sci.</u> 6:251-53

(1966), or by similarly analyzing oil extracted from a whole seed. The latter approach does not save the embryo for germination. The screening can be performed before an initial selfing step or, if a greater degree of segregation is desired, after a self-pollination of plants grown from the bulk seed.

The embryos from seeds thus identified as having an oleic value of about 45% or more can then be germinated in the conventional manner, grown out to maturity, and self-pollinated to increase supply of the selected germplasm. At this stage and others of the method described herein, the growing conditions are preferably such that heat and moisture stress are avoided. Seeds from selfed plants are then grown out and crossed with individuals of the same selfed population ("sib pollination") in such a way as to maximize the combinations of pollinations within the population.

The offspring of the sib pollination are again screened for high oleic value, and a percentage of progeny representing an upper range of oleic acid content, preferably the upper 10%, are selected. The upper range employed for selection is chosen to balance the rapidity with which oleic acid content is raised in a population versus the quantitative level of oleic value ultimately attained for that population. Lower selection pressure will maintain a higher level of genetic variability within the population. A further cycle of sib pollination and selection is then carried out, using plants grown from seed representing the selected upper range. Generally, within two to four such cycles of recurrent selection one can proceed from starting material, chosen from the subgroup defined above, to a corn variety that is characterized by mean oleic values for kernel bulks that are 55% or greater, for example, in the range from about 60% to 75%.

Between two to four additional cycles of self-pollination and selection will typically be needed to

reach a state of relative homogeneity, at least with respect to high oleic value, that is indicative of a true-breeding variety or line. In any event, single-kernel oleic values in excess of 65%, preferably around 70% to 85%, can be achieved in association with such inbreeding of high oleic varietal material within the present invention.

The fatty acid composition of corn seeds developed in the breeding program can be determined by GLC in accordance with the procedures described in Jellum and Worthington, supra. GLC analysis can be conducted on a five- (or more) kernel bulk sample and on a one-half kernel sample, which allows the planting of the remaining half-seed for further breeding.

Elite high oleic acid corn lines (oleic acid lines and oleic lines are used interchangeably herein) can be developed by crossing the high oleic line (derived from a high oleic acid P.I. population) with an agronomically elite line for a given maturity region. For example, LH85 is an elite corn inbred line which has an oleic acid content ranging from 26.1% to 35.9%. 85-205-6 is a high oleic acid line developed by the procedures of this invention. By crossing LH85 with 85-205-6, followed with two to four generations of selfing and selection of high oleic lines with agronomically desirable traits, the lines resulting from this breeding effort exhibit high oleic acid content along with acceptable agronomic traits such as plant vigor, good stalks and roots, disease resistance, and the like. Crossing high oleic lines with a number of elite lines and selfing and selecting from these crosses can produce numerous new high oleic acid corn lines. These lines can be adapted to any maturity region desired by selecting the appropriate maturity level in the elite corn parent and selecting for the desired maturity in subsequent selfing generations. The high oleic acid

lines developed by the present invention can be used as one or more parents in corn hybrids.

Also, one or more backcrosses to the elite recurrent parent can be accomplished to incorporate a higher percentage of the elite germplasm characteristics while retaining the high oleic trait. For example, the cross PA91 x 85-205-21 was backcrossed to PA91 (designated as PA91^{2}85-205-21), which was then selfed, and selections made for high oleic lines. PA91 is an elite 128-day maturity corn inbred line developed at Pennsylvania State University. 85-205-21 is a high oleic acid line developed by the procedures described herein. The five kernel bulk GLC assay of ear 19 of this backcross had an oleic acid content of 56.4%. The half-kernel GLC assay of kernel 31 from ear 19 had a 72.4% oleic acid level. The remaining half-kernel 31 from ear 19 is planted and used in further breeding procedures, such as (1) further selfing and selection, (2) making additional backcrosses to the PA91 recurrent parent to incorporate more of the PA91 elite background, (3) crossing with other elite lines to incorporate desired traits while maintaining the high oleic acid trait, and (4) conducting other conventional breeding procedures to develop commercially viable corn inbreds and hybrids.

As mentioned above, an inbred line that is true-breeding for a high oleic acid phenotype according to the present invention is advantageously employed in a backcrossing program to introgress the high oleic trait into other, more agronomically desirable lines. For example, a true-breeding inbred line of the present invention can be the donor parent for backcrossing to a waxy corn line, to thereby produce a high oleic waxy hybrid or line. In this regard, a "hybrid" would be an offspring obtained by crossing parent plants of different lineage.

As disclosed, for example, by Coe et al., in Corn and Corn Improvement (3d ed.), Sprague, G.F. and Dudley,

J.W., Eds., p. 142-143 (American Society of Agronomy, Madison, Wis., 1988) (hereinafter "Coe et al. (1988)"), the waxy type of kernel is so unique and its expression so unconfounded that the waxy trait is conventionally used as a universal marker. The waxy endosperm chips away evenly when cut with a blade, leaving a smooth, opaque surface, while normal endosperm breaks unevenly and leaves an irregular, translucent surface. In addition, the starch in the outer surface of a non-waxy endosperm stains blue, turning quickly to black, with an iodine (I_2)-potassium iodide (KI) solution, while that of material homozygous for the waxy allele (wx1) stains reddish brown, turning soon to dark brown.

The uniqueness of the waxy trait allows for the ready backcrossing to a recurrent waxy parent of progeny that are (high oleic x waxy) hybrids, according to the present invention, against a donor waxy (wx1/wx1) parent. That is, progress can be readily monitored for a backcrossing generation whereby the germplasm contribution of the high oleic donor, save for the expression of a mean oleic value of 45% or greater, is virtually eliminated.

Introgression of a high oleic phenotype as described above can also be accomplished with regard to genetic backgrounds characterized by traits other than waxy. Illustrative of traits that could be combined with a high oleic phenotype, pursuant to the present invention, are those listed in Table 2.

TABLE 2. EXEMPLARY CORN TRAITS TO COMBINE WITH HIGH OLEIC ACID PHENOTYPE

Determinant*	Description
Endosperm Mutants	
ael[s]	"amylose extender": amylose fraction of starch increased to 50% (glassy, tarnished endosperm); ael gene plus modifiers provides a range in amylose from about 50% to 80%, but the amylose content can be stabilized at intermediate levels; Vineyard & Bear, Corn Genet. Coop. Newsltr. 26:5 (1952)
o2[s]	"opaque-2 endosperm": reduced zein and increased lysine in endosperm (soft, chalky, non-transparent kernels; little, hard, vitreous or horny endosperm); Nelson et al., Science 150:1469-70 (1965)
Resistance to Common Leaf Rust (Puccinia sorghi):	
Rp1	Mains, J. Hered, 17:313-25 (1926); J. Agric. Res. 43:419-30 (1930)
Rp3[s]	Wilkinson & Hooker, Phytopathol. 58: 605-08 (1968)
Rp4[s]	Wilkinson & Hooker, loc. cit. (1968)
Rp5[s]	Saxena & Hooker, Proc. Nat'l Acad. Sci. USA 61:1300-05 (1968)
Rpp9[s]	resistance to southern leaf rust (Puccinia polysora Underw.); Ullstrup, Phytopathol. 55:425-28 (1965)
Resistance to Northern Leaf Spot (Cochliobolus carbonum Nelson):	
Hm1	confers full resistance, although some alleles are intermediate; Nelson & Ullstrup, J. Hered. 55: 194-99 (1964), Hamid et al., Phytopathol. 72:1169-73 (1982)

TABLE 2. EXEMPLARY CORN TRAITS TO COMBINE WITH HIGH OLEIC ACID PHENOTYPE (Cont'd)

Determinant*	Description
Hm2	confers resistance, in the presence of homozygous recessive hm1, that is lower initially but becomes progressively stronger as the plant develops. Nelson & Ullstrup, J. Heredity 55:194-99 (1964), Hamid et al., Phytopathol. 752:1169-73 (1982)
Resistance to Southern Corn Leaf Blight (Bipolaris maydis) (Nisik.) Shoemaker (race 0):	
rhm1[s]	Smith & Hooker, Crop Sci. 13:330-31 (1973)
Resistance to Northern Leaf Blight (Helminthosporium turcicum Pass.):	
Ht1[s]	Hooker, Crop Sci. 3:381-83 (1963)
Ht2[s]	Hooker, loc. cit. 17:132-35 (1977)
Ht3[s]	Hooker, Corn Genet. Coop. Newsltr. 55:87-88 (1981)
Bx1	resistance to H. turcicum (reduces levels of H. turcicum infection in genotypes ht1/ht1 Bx1/Bx1 and Ht1/Ht1/Bx1/Bx1, relative to bx1/bx1 counterparts); Couture et al., Phys. Plant Pathol. 1:515-21 (1971)
Aphid, Corn, Mosaic, Virus I, Eradicane™ Herbicide, Drought, Heat & Aluminum Tolerance	
aph1	resistance to corn leaf aphid (Rhopalosiphum maidis Fitch.); Change & Brewbaker, Corn Genet. Coop. Newsltr. 50:31-32 (1976)
Mv1	resistance to corn mosaic virus I; Brewbaker, in Proc. 29th Ann. Corn & Sorghum Res. Conf. 118-33 (1974)
thc1	tolerance to Eradicane™ (S-ethyldipropylthiocarbamate plus R25788 safener); Pfund & Crum, Agronomy Abstr., p. 66 (1977)

TABLE 2. EXEMPLARY CORN TRAITS TO COMBINE WITH HIGH OLEIC ACID PHENOTYPE (Cont'd)

Determinant*	Description
lte1	Miranda, Corn Genet. Coop. Newsltr. 55:18-19 (1981) (also conditions frost resistance)
Lte2	Miranda, loc. cit. 56:28-30 (1982)
Conditions pollen competition, disfavoring fertilization of silks with same genotype by pollen of another (Ga1-S pollen outcompetes ga1 pollen for Ga1-S silks); maintains isolation of strains from outcrossing	
Ga1-S^{s}	D. Schwartz, Proc. Nat. Acad. Sci. USA 36:719-724 (1950)
GA8	Schwartz, Corn Genet. Coop. Newsltr. 25:30 (1951)

* Designation of determinations conforms to usage in linkage map of Coe et al. (1988). A superscript "s" indicates availability from the Corn Genetic Stock Center, Department of Agronomy, University of Illinois (Urbana).

In addition, various approaches to imparting male sterility in corn can be used to produce male-sterile, high oleic acid material within the present invention, which material can be employed in turn to produce hybrids which also display a high oleic acid phenotype according to the present invention. An inbred line possessing such a high oleic acid phenotype can thus be advantageously employed in a backcrossing program as a recurrent parent to cytoplasmic-genetic, male-sterile donors containing both nuclear and cytoplasmic factors imparting male sterility (A lines), to donors containing nuclear but not cytoplasmic factors imparting male sterility (B lines), and to donors containing nuclear

and cytoplasmic factors that restore fertility to male-sterile material (R lines), as described, for example, by Coe et al. (1988), at pages 195-98 and pages 206-09, and Poehlman, "Breeding Field Crops" (2d ed.), AVI Publishing Co. (1979), at pages 292-95. Sources for cytoplasmic male-sterility (cms) and fertility restoration (Rf) factors include Holden's Foundation Seeds, Inc., P.O. Box 839, Williamsburg, Iowa 52361 (cms-S and cms-C); Illinois Foundation Seeds, Inc., P.O. Box 722, Champaign, Illinois 61820 (cms-S and cms-C); and Agronomy Department, University of Illinois, Urbana, Illinois (cms-T, cms-S, cms-C and various Rf determinations).

EXAMPLES

The following examples are provided to further illustrate the present invention and are not intended to limit the invention beyond the limitations set forth in the appended claims.

EXAMPLE 1

Determination of Fatty Acid Content

The fatty acid composition of corn seeds developed in the breeding program was determined by GLC in accordance with the procedures described below.

The oil was obtained by using a corn oil extraction protocol having the following steps:

1. A sample of corn was removed from the ear and was then catalogued according to row number and pedigree.

2. The sample was crushed with a pestle in a mortar. Ether was added and the sample was crushed further for ten seconds.

3. This solution was then drawn up through non-absorbing cotton into a pipette. The clean solution was then put into a test tube.

4. Three drops of tetramethylammonium hydroxide or sodium methoxide were added to the solution in the test tube and allowed to react for five minutes.

5. After five minutes, distilled water was added to the solution to raise the liquid level in the test tube. Since oil is lighter than water, the oil was easily siphoned off the top layer.

6. The oil drawn off was placed in 2 ml vials. Ether was added to raise the level to three-fourths full.

7. The vial was then capped and thus ready to be processed through the gas liquid chromatograph.

For the analyses of one-half seed samples, individual seeds were cut in half with a razor blade. The halves containing the scutella were then placed in a mortar with a small amount of ether, approximately 1 to 1.5 ml. The pieces were crushed and stirred for approximately 10 seconds with a pestle, and the solution drawn up through non-absorbent cotton and placed in a test tube. A 0.5 ml sample of the ether extractant was then treated in the manner described above. The fatty acid analysis of one half-seed allowed planting of the remaining half-kernel in a breeding nursery and conducting of additional research and development with this genotype.

The GLC analyses were accomplished using a 5890A Hewlett-Packard gas liquid chromatograph equipped with a flame ionization detector and a Hewlett-Packard 3396A integrator. The column used was a Supelco 2330 fused silica capillary column (having a film thickness of 0.2 micron and column dimensions of 15 m. x 0.25 mm.). The operating conditions for the GLC analysis included an injector temperature of 250 degrees Celsius and a detector temperature of 300 degrees Celsius. Column flow was 2.0 ml/min. of helium. Each chromatographic run was temperature-programmed to begin at 170 degrees Celsius

and remain at that temperature for 1.0 min. The temperature was then increased to 180 degrees Celsius at a rate of 1 or 2 degrees Celsius/min. After this period of time, the chromatograph was completed and the column prepared for the next run.

EXAMPLE 2

Development of High Oleic Acid Corn Lines 85-205-6 and 85-205-21 from Plant Introduction Germplasm

In an exemplary embodiment of the present invention, seed from P.I.'s representing corn material within the above-defined subgroup of suitable starting materials was obtained from the USDA Plant Introduction Station at Iowa State University and, after a grow-out and selfing step, seeds from ears of the selfed P.I.'s were screened for low linoleic acid content via GLC. Prior to 1982, at least two cycles of recurrent selection for low linoleic acid level had occurred. P.I.'s were the progenitors of the recurrent selection population.

Sibbing in 1982 was conducted by mixing pollen of five to eight plants from the first seven rows and pollinating plants in the second eight rows, and vice versa, on several days. Eighty sibbed ears were harvested from this block and analyzed for oil composition, with results as shown in Table 3.

TABLE 3. OLEIC ACID VALUES OF 80 S0 SIBBED EARS HARVESTED IN 1982

Ear	Oleic Acid	Ear	Oleic Acid	Ear	Oleic Acid
-1	49.77	-27	47.25	-53	49.32
-2	47.20	-28	48.23	-54	50.58
-3	44.29	-29	46.11	-55	36.93
-4	45.13	-30	47.56	-56	40.81
-5	48.58	-31	50.06	-57	44.13
-6	46.41	-32	50.03	-58	47.75
-7	49.16	-33	48.64	-59	47.21
-8	48.93	-34	53.81	-60	31.86
-9	43.06	-35	50.02	-61	50.99
-10	53.15	-36	49.41	-62	48.67
-11	52.67	-37	55.21	-63	52.19
-12	52.34	-38	51.66	-64	46.57
-13	47.05	-39	48.16	-65	52.37
-14	48.37	-40 **	53.07	-66	47.75
-15	41.06	-41	47.29	-67	50.91
-16	48.97	-42	47.13	-68	50.01
-17	51.53	-43	44.42	-69	49.03
-18	48.91	-44	45.39	-70	43.08
-19	53.16	-45	49.42	-71	55.38
-20	50.80	-46	42.73	-72	46.76
-21	54.01	-47	45.70	-73	49.86
-22	43.87	-48	50.44	-74	50.24
-23	45.54	-49	43.85	-75	47.68
-24	50.18	-50	43.36	-76	45.38
-25	43.94	-51	58.98	-77	46.51
-26	24.02	-52	52.01	-78	42.88
				-79	52.36
				-80	40.73

** Seed harvested from this ear was used for planting row 9 in 1983.

Ten S0 ears from the 1982 sibbed ears of 80 were grown in 1983 for selfing in one block and in another block for the next cycle of sibbing. One sibbing block of 15 rows was designated as 82-805. A group of 24 selfed ears was analyzed for fatty acid composition with the results shown in Table 4.

TABLE 4. OLEIC ACID VALUES OF 24 SELFED (S1) EARS HAR . STED IN 1983

Row No.	Oleic Acid	Row No.	Oleic Acid
83-221-1	53.45	-13	61.19
-2	65.08	-14	54.25
-3	58.65	-15	56.62
-4	56.79	-16	48.28
-5	56.27	83-221-17	55.11
-6	52.01	-18	57.88
-7	47.81	-19	54.67
-8	51.00	-20	58.45
83-221-9 **	71.13	-21	56.72
-10	60.07	-22	51.05
-11	58.42	-23	55.06
-12	55.85	-24	57.66

** Seed harvested from this row was used for r ting row 205 in 1985.

One ear, 83-221-9, was planted in a four-row nursery block (85-205) and selfed in 1985. The nursery notes recorded the plot as having "good plants," which were five to six feet tall. At harvest, the ears were described as "medium small" and "segregating" (as to color, etc.). In the seed room, five ears were discarded and 32 ears were shelled and individually packaged. One ear was identified as 85-205-6, and a second as 85-205-21. GLC assays on 8-10 kernel bulks showed 85-205-21 had an oleic acid percentage from 73.2% to 75.8%, while 85-205-6 had 69.7% mean oleic acid content.

EXAMPLE 3

Development of High Oleic Acid Corn Genotypes From 85-205-21

Seeds from genotype 85-205-21 were grown out and the resulting plants were self-pollinated. Single kernels from an S2 ear (10760109-1) analyzed via GLC resulted in oleic acid contents ranging from 67.7% to 73.1%. Selection 10760109-1 was selfed, and GLC assays of half-kernels from S3 ears resulted in oleic values from 66.1% to 76.1%.

Kernel 4 of S3 ear 10833030-11 was selected for planting in the summer nursery at Breckenridge, Minnesota during 1988. This plant was self-pollinated. Half-seed assays from the selfed ear with the highest oleic values revealed a level of homogeneity, in terms of oleic value for that ear (five kernels assayed: 77.3%, 76.8%, 78.1%, 80.9%, 80.3%). Half-seed assays of other S4 ear seeds obtained from selfing other selected S3 genotypes yielded the highest oleic value (82.1%) overall, with a lowest value on the same ear of 70.8%. No ear provided an oil from bulked seed that was less than 64.1% in oleic value. Further selfing results in lines which are true-breeding for a mean oleic acid content in excess of 65%.

With the high oleic acid corn material of the present invention, corn oil can be produced having a higher percentage of oleic acid than any achieved heretofore, one comparable to commercially-available rapeseed (canola) oil and higher than most sunflower oils. This elevated oleic value is advantageous, both from the standpoint of increased oxidative stability for the oil and the health benefits associated with dietary substitution of monounsaturated for polyunsaturated fatty acids.

EXAMPLE 4

Development of Commercially Acceptable, High Oleic Corn Genotypes

In the 1987 summer nursery at Breckenridge, the fatty acid corn material 85-205-6 was grown. The inbred line LH85, in row 8701013923, was used as the female parent in a cross with plant number 4 of 85-205-6 in row 8701013832. Single kernels of LH85 have oleic acid contents of 26.1% to 35.9%. LH85 is a proprietary line available under license from Holden's Foundation Seeds, Inc., and developed from selfing directly out of Pioneer Hi-Bred International's 3978 hybrid. The pollen parent (85-205-6) was a plant grown from seed which showed a 69.7% mean oleic acid content when a bulk of 10 kernels was previously assayed (see Example 2).

In the 1987 fall greenhouse at Breckenridge, the F1 plants from the above-stated cross were grown in row 10710121 and selfed. An assay of approximately five kernels from the third plant showed a mean oleic acid content of 46.7%.

In the 1988 summer nursery, the seed from the 1987 fall greenhouse was planted. Resulting plants were selfed. When harvested, all ears were placed in a bag. Half-kernel GLC assays of the 14th kernel from the seventh ear revealed an oleic acid content of 75.3%. In the 1989 spring greenhouse, the one-half kernel was germinated, transplanted, and labelled as the first plant in row 10821193. This plant was selfed. No assays were performed on seeds from this plant.

In the 1989 summer nursery at Breckenridge, seed of the selfed plant (10821193) was grown in rows 10901914 and 10901915. All plants were selfed. Ears were harvested and placed into a bag labelled 10901914. Assays of five kernel bulks were performed on seeds from ears 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 and 15. One-half kernel assays were then conducted on single kernels from all ears except for ears 8, 11 and

12. With the exception of one seed in ear 14, all oleic acid contents were at least 70.9%. The lower oleic acid content of the seed from ear 13 was most likely accidental out crosses to plants having lower oleic acid genotypes. Results of the GLC assays are shown in Tables 5 and 6.

TABLE 5. OLEIC ACID VALUES BY EAR

		Single Kernels		
Ear	5 Kernel Bulk	High	Low	Mean
1	76.8	81.3	72.8	76.8
2	76.7	76.6	75.6	76.2
3	75.2	79.5	74.5	77.4
4	75.7	77.3	74.6	75.6
5	77.0	79.0	70.9	76.6
6	75.0	79.1	76.2	77.2
7	76.8	80.8	74.8	78.2
8	74.5	--	--	--
9	75.1	77.0	72.3	75.8
10	76.1	78.0	75.6	76.8
11	73.9	--	--	--
12	73.5	--	--	--
13	69.7	74.4	60.0	71.3
14	77.5	81.1	78.6	79.6
15	77.2	77.6	73.3	76.4

TABLE 6. OLEIC ACID VALUES BY KERNEL

Ear. Kernel*	Oleic Acid	Ear. Kernel*	Oleic Acid	Ear. Kernel*	Oleic Acid
1.1	77.1	6.1	77.7	11.1	75.6
1.2	77.1	6.2	78.1	11.2	78.0
1.3	77.2	6.3	78.3	11.3	76.2
1.4	76.9	6.4	79.0	11.4	76.7
1.5	76.5	6.5	78.3	11.5	77.3
1.6	72.8	6.6	71.7		
1.7	76.0	6.7	76.1	14.1	60.0
1.8	76.7	6.8	77.0	14.2	71.4
1.9	77.4	6.9	76.7	14.3	72.2
1.10	81.3	6.10	70.9	14.4	70.2
1.11	75.0	6.11	75.4	14.5	73.9
1.12	78.1	6.12	77.2	14.6	71.5
1.13	75.5	6.13	77.5	14.7	71.1
1.14	77.3	6.14	77.0	14.8	70.5
1.15	77.1	6.15	77.5	14.9	71.4
				14.10	73.3
2.1	75.7	7.1	77.0	14.11	71.6
2.2	76.6	7.2	79.1	14.12	73.6
2.3	75.6	7.3	77.0	14.13	74.4
2.4	76.4	7.4	76.5	14.14	73.4
2.5	76.6	7.5	76.2	14.15	70.1
				14.16	71.6
3.1	76.8	8.1	80.8		
3.2	78.3	8.2	80.1	15.1	78.6
3.3	78.3	8.3	79.4	15.2	81.1
3.4	76.7	8.4	77.6	15.3	79.8
3.5	76.7	8.5	79.3	15.4	78.7
3.6	77.9	8.6	78.5	15.5	80.0
3.7	74.5	8.7	76.5		
3.8	79.5	8.8	79.5	16.1	77.3
3.9	76.1	8.9	77.7	16.2	76.9
3.10	77.5	8.10	78.5	16.3	77.0
3.11	78.2	8.11	76.5	16.4	77.6
3.12	76.9	8.12	76.5	16.5	73.3
3.13	79.1	8.13	74.8		
3.14	78.1	8.14	78.1		
3.15	76.0	8.15	79.9		
4.1	76.6	10.1	76.4		
4.2	74.9	10.2	77.0		
4.3	77.3	10.3	72.3		
4.4	74.6	10.4	76.4		
4.5	74.8	10.5	76.7		

* 1.1 = ear 1, kernel 1
1.2 = ear 1, kernel 2, etc.

By following the above procedure and using the following elite corn varieties in place of LH85, high oleic corn lines are obtained having mean oleic acid contents greater than 45%.

	Oleic Acid %
McCurdy's 74-41 (MC 74-41)	31.8 - 34.2
B73	22.0 - 39.8
Mo17	19.2 - 22.9
M50-1	18.1 - 25.6
PA91	29.7 - 32.5
Jacques 17 (J17)	20.7 - 32.0
McCurdy's 731 (MC731)	23.9 - 26.2
McCurdy's 75-103 (MC75-103)	25.3 - 27.5
McCurdy's 851 (MC851)	32.6 - 34.7

By following the above procedure and using any commercially acceptable elite corn lines, high oleic corn lines are obtained having a mean oleic acid content greater than 45%.

EXAMPLES 5-11

Development of High Oleic Corn Lines in a Backcross Method

In another embodiment of the present invention, one or more backcrosses to the elite recurrent parent are made to incorporate a higher percentage of the elite germplasm characteristics, while retaining the high oleic acid trait.

Backcrosses have been made between high oleic acid selections and elite recurrent parents, including B73, Mo17, PA91, J17, M50-1, MC74-41, MC75-103, MC851 and MC731. GLC analysis of approximately 2,936 selfed backcross half-kernels has resulted in about 40 kernels which are backcrossed to the recurrent parent. Examples of appropriate high oleic acid selections are indicated with a superscript "1" in the following tables.

EXAMPLE 5

Development of High Oleic Corn Line Using PA91 as the Recurrent Parent

PA91 was crossed with previously identified high oleic line 85-205-21 in the Breckenridge winter greenhouse in 1989. PA91 is an elite, 128-day maturity corn inbred developed at Pennsylvania State University. PA91 was selected from the genetic background of [(Wf9 x Oh40B)^4] x [(Ind 38-11 x L317) Ind 38-11^4]. 85-205-21 is a high oleic line developed in Example 2 above. The seed of this cross was grown at Lincoln, Illinois and the first backcross was then made to recurrent parent PA91. Seed of the first backcross was planted in Puerto Rico, where the plants were selfed. The five-kernel bulk GLC assay of BC1 selfed ear 19 had 56.4% oleic (see Table 7). The half-kernel GLC assay of kernel 31 from ear 19 had a 72.4% oleic acid content (see Table 8). Individual kernels identified in Table 8 with a superscript "1" in the first column (row number) are backcrossed to the elite PA91 parent.

TABLE 7

FATTY ACID CONTENT OF OIL FROM FIVE KERNEL BULK OF PEDIGREE PA91^{2}HO) BC1

	OIL COMPOSITION (%)			
ROW NO.-EAR	PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
3908698-1	8.9	2.1	47.2	41.0
-2	9.7	1.5	44.5	44..
-3	12.4	2.0	47.7	37.0
-4	12.0	1.8	40.7	45.5
-5	10.3	2.1	35.8	51.9
-6	10.9	1.9	39.4	47.1
-7	11.2	1.8	53.5	32.8
-8	11.8	2.2	34.2	51.7
-9	11.0	1.8	46.9	39.6
-10	13.4	2.0	34.2	49.7
-11	8.5	1.8	36.3	52.6

TABLE 7 (cont'd)

FATTY ACID CONTENT OF OIL FROM
FIVE KERNEL BULK OF PEDIGREE PA91^{2}HO BC1

ROW NO.-EAR	OIL COMPOSITION (%) PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
3908698-12	13.1	2.0	36.4	48.5
-13	12.9	1.7	30.3	55.1
-14	11.1	2.5	36.5	49.0
-15	11.2	1.5	55.4	30.8
-16	13.1	1.7	46.5	38.7
-17	12.1	1.9	43.4	41.8
-18	10.7	2.1	41.4	44.8
-19	9.1	2.1	56.4	31.1
-20	8.3	1.9	35.6	53.2

TABLE 8

FATTY ACID CONTENT OF OIL FROM 1/2 KERNEL
OF PEDIGREE PA91^{2}HO BC1

ROW NO.-Ear.Kernel	OIL COMPOSITION (%) PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
3908698-19.1	6.9	2.4	63.0	27.8
-19.2	8.4	2.6	67.4	19.3
-19.3	10.3	3.0	47.1	39.6
-19.4[1]	8.6	3.0	70.3	18.1
-19.5	10.9	2.9	39.2	46.9
-19.6	11.2	3.1	41.9	43.8
-19.7	8.3	3.4	45.1	43.1
-19.8	11.9	2.9	45.1	39.3
-19.9	10.3	2.3	45.9	41.5
-19.10	12.8	2.1	40.1	44.0
-19.11	7.0	2.3	47.7	41.8
-19.12	13.6	3.5	42.9	39.9
-19.13	7.1	2.8	43.0	45.6
-19.14	11.1	2.5	53.5	30.5
-19.15	10.0	2.2	36.7	50.1
-19.16	9.1	4.2	68.3	18.3
-19.17	9.2	2.8	56.2	31.9
-19.18	7.0	2.8	46.2	44.0
-19.19	6.7	2.5	54.0	32.4
-19.20	12.9	3.8	40.5	42.8
-19.21	12.3	3.0	60.8	21.4

TABLE 8 (cont'd)

ROW NO.-Ear.Kernel	PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
	OIL COMPOSITION (%)			
3908698-19.22	11.2	2.4	43.9	41.2
-19.23	12.2	2.5	50.4	33.7
-19.24	8.3	2.5	42.4	44.3
-19.25	10.5	2.9	43.9	41.3
-19.26[1]	5.8	2.0	71.4	19.6
-19.27	9.8	2.6	45.4	40.2
-19.28	9.0	1.9	69.2	18.1
-19.29	9.0	2.4	61.0	25.5
-19.30	10.4	2.6	53.4	31.0
-19.31[1]	5.7	1.9	72.4	18.5
-19.32	10.2	2.1	44.3	40.8
-19.33	8.9	2.8	69.4	17.1
-19.34	9.8	2.9	36.1	49.4
-19.35	10.5	3.1	47.4	37.1
-19.36	10.5	3.2	51.4	33.6
-19.37	11.1	2.8	48.2	34.3
-19.38	7.6	3.0	65.4	22.2
-19.39	10.8	2.3	56.1	28.4
-19.40	9.9	2.9	41.9	43.1
-19.41	9.6	2.1	57.1	29.2
-19.42	10.0	3.6	45.4	39.2
-19.43	10.1	3.6	41.7	43.2
-19.44	9.5	3.2	45.9	41.4
-19.45	10.0	2.2	36.9	49.5
-19.46	13.1	3.0	37.9	43.0
-19.47	9.6	3.0	40.2	45.6
-19.48	10.9	2.7	37.2	47.5
-19.49	10.8	2.4	43.3	42.1
-19.50	9.7	2.3	46.7	39.7
-19.51	7.8	2.8	38.6	48.5
-19.52	9.2	3.3	49.4	36.6
-19.53	10.4	2.6	33.8	51.1
-19.54	12.6	2.2	41.9	41.9
-19.55	7.0	2.6	46.3	42.5
-19.56	6.1	2.4	69.9	20.1
-19.57	12.0	--	50.1	34.6
-19.58	9.3	2.3	47.0	40.1
-19.59	7.2	3.4	41.9	46.0
-19.60[1]	10.0	2.7	71.5	14.7
-19.61	9.6	2.0	49.5	37.5
-19.62	10.1	3.6	36.2	48.4
-19.63	9.4	2.5	35.1	52.4
-19.64	7.3	2.8	39.6	48.1
-19.65	9.9	3.0	47.1	38.1
-19.66	7.2	2.0	66.0	23.0
-19.67	8.6	3.6	43.5	42.8
-19.68	9.4	3.2	41.7	44.3

TABLE 8 (cont'd)

ROW NO.-Ear & Kernel	OIL COMPOSITION (%) PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
3908698-19.69	9.1	2.4	64.6	22.6
-19.70	8.3	2.4	36.8	50.1
-19.97[1]	6.7	3.4	70.6	17.7
-19.104[1]	6.2	2.5	70.2	19.9
-19.130[1]	5.8	1.7	71.1	19.3
-55.16[1]	9.8	2.2	70.0	18.0

Elite corn inbreds having substantially the same characteristics as PA91, but with the high oleic acid trait from 85-205-21, are produced in two to six backcrosses by backcrossing to the elite parent and then selfing and selecting high oleic acid segregates.

EXAMPLE 6

Development of High Oleic Corn Line Using MC731 as the Recurrent Parent

In another embodiment to the present invention, one backcross was made to elite parent MC731 to incorporate a higher percentage of the elite germplasm characteristics of MC731, while retaining the high oleic trait.

High oleic corn line 85-205-21 was crossed with MC731. MC731 is a proprietary line developed by McCurdy's Seed Company, Fremont, Iowa. The background of MC731 is $B73^2N7A$. $B73^2N7A$ is an abbreviation of the cross (B73 x N7A)B73. The background of 85-205-21 is described in Example 2.

The MC731 x (85-205-21) cross was backcrossed to MC731. Five kernel bulks of individual S1 ears from this cross were assayed using the GLC methods described previously in Example 1. As shown in Table 9, ear 1 from row 151 has an oleic value of 67.5%. Upon further GLC analysis of individual kernels from ear 1 of row 151

(shown in Table 10), kernel 4 of ear 1 had an oleic percentage of 73.9%, kernel 27 had a percentage of 72.3% and kernel 38 had a percentage of 75.3%. These values are greater than the maximum oleic acid percentage previously reported in corn. Kernels identified in Table 10 with a superscript "1" in the first column (row number) are backcrossed to the MC731 parent. High oleic inbreds having substantially the same characteristics as MC731 are produced in accordance with Example 5. Alternatively, the kernels are further selfed to develop elite lines.

TABLE 9

FATTY ACID CONTENT OF OIL FROM FIVE KERNEL BULK OF PEDIGREE MC731[2]HO BC1

	OIL COMPOSITION (%)			
ROW NO.-Ear	PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
143-1	7.8	1.6	41.5	48.1
143-2	8.8	1.7	54.9	36.6
143-3	8.8	1.7	44.1	44.5
144-1	7.3	2.5	29.6	59.6
144-2	9.3	1.9	46.9	40.1
144-3	8.1	2.0	31.2	57.8
144-4	7.2	2.5	42.8	46.5
144-5	9.8	1.5	36.0	51.8
145-1	9.9	2.6	51.8	34.7
146-1	7.4	1.9	44.2	45.6
147-1	6.8	2.0	46.0	45.2
148-1	9.1	2.5	67.2	20.4
149-1	8.2	1.7	51.1	38.0
150-1	9.0	2.4	35.4	52.3
150-2	7.2	1.7	45.3	45.7
151-1	6.8	2.0	67.5	23.7
152-1	6.9	2.4	61.8	28.4
153-1	9.3	2.3	38.6	48.8

TABLE 10

FATTY ACID CONTENT OF OIL FROM
1/2 KERNEL OF PEDIGREE MC731[2]HO BC1

	OIL COMPOSITION (%)			
ROW NO.-Ear.Kernel	PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
151-1.1	8.5	1.9	35.0	53.0
1.2	7.8	2.6	37.8	50.2
1.3	8.2	2.1	51.9	36.3
1.4[1]	7.5	2.5	73.9	14.8
1.5	7.7	2.0	49.5	39.3
1.6	9.4	2.2	49.8	37.4
1.7	9.0	2.3	42.6	43.9
1.8	8.2	2.5	45.9	41.9
1.9	6.5	2.1	54.7	35.5
1.10	8.8	2.1	49.8	39.3
1.11	7.3	2.2	69.5	19.4
1.12	9.9	1.6	36.4	50.6
1.13	8.7	2.1	46.9	40.7
1.14	10.2	2.8	48.9	38.2
1.15	8.1	1.8	66.4	22.2
1.16	9.4	2.3	47.0	39.3
1.17	7.0	2.5	55.4	32.2
1.18	7.9	2.5	43.5	44.1
1.19	7.4	1.9	50.9	38.4
1.20	6.3	2.0	54.7	36.1
1.21	5.4	2.1	41.2	50.1
1.22	10.0	2.4	44.5	41.7
1.23	8.1	2.0	63.4	24.9
1.24	5.7	1.6	47.6	43.4
1.25	6.5	2.2	50.4	39.6
1.26	9.9	2.7	50.9	35.1
1.27[1]	6.8	2.3	72.3	17.0
1.28	5.9	2.1	47.9	42.5
1.29	9.6	2.3	40.5	46.1
1.30	7.1	2.2	36.7	52.4
1.31	7.7	2.1	50.9	37.5
1.32	10.1	1.8	27.4	59.1
1.33	8.0	2.8	45.7	41.3
1.34	8.5	2.1	37.1	50.7
1.35[1]	6.7	2.3	70.5	19.3
1.36	6.5	2.6	42.0	47.4
1.37[1]	7.5	2.2	72.3	16.6
1.38[1]	6.2	2.5	75.3	14.2
1.39	7.5	2.9	34.9	53.1
148-1.7[1]	8.9	2.4	70.9	16.5

EXAMPLE 7

Development of High Oleic Corn Line
Using MC851 as the Recurrent Parent

In another embodiment of the present invention, one backcross was made to elite parent MC851 to incorporate a higher percentage of the elite germplasm characteristics of MC851, while retaining the high oleic trait.

High oleic acid corn line 85-205-21 was crossed with MC851. MC851 is a proprietary line developed by McCurdy's Seed Company, Fremont, Iowa. MC851 was derived from the cross MC825 x MC850. The background of M825 is T204 x SC276, while MC850 was developed from SC276 x AB18E. The background of 85-205-21 is described in Example 2.

The MC851 x (85-205-21) cross was backcrossed to MC851. Five kernel bulks of individual S1 ears derived from this $MC851^2$ 85-205-21 cross were analyzed using the GLC method described previously in Example 1. As shown in Table 11, ear 2 from row 094 had an oleic value of 68.3%. Upon further GLC analysis of individual kernels from ear 2 (see Table 12), kernel 21 had 73.3% oleic acid and kernel 64 had 73.2% oleic acid. All of these values are greater than any previously reported for corn. Kernels identified in Table 12 with a superscript "1" in the first column are backcrossed to the MC851 parent.

High oleic acid inbreds having substantially the same characteristics as MC851 are produced in accordance with Example 5 above. Alternatively, the kernels are further selfed to develop elite lines.

TABLE 11

FATTY ACID CONTENT OF OIL FROM FIVE KERNEL BULK OF PEDIGREE MC851^{2}HO BC1

	OIL COMPOSITION (%)			
	PALM	STEA	OLEI	LINO
ROW NO.-Ear	16:0	18:0	18:1	18:2
092-1	13.8	1.8	40.7	43.8
-2	11.6	2.1	47.6	38.0
-3	13.7	1.9	39.3	45.0
-4	13.2	1.2	51.6	33.9
-5	14.2	2.0	38.1	45.7
-6	11.4	1.8	41.3	44.8
-7	14.8	2.0	36.7	45.9
093-1	12.9	1.6	38.7	46.8
-2	13.6	1.8	41.2	43.5
094-1	15.2	2.3	41.7	40.9
-2	7.3	1.9	68.3	22.5
-3	14.6	1.7	37.8	45.9
-4	14.7	1.6	48.1	35.6
095-1	11.4	2.2	40.1	45.7
-2	14.0	1.5	38.9	45.0
-3	11.6	1.6	49.5	37.2
-4	11.9	1.9	44.7	41.5
096-1	11.6	1.8	51.6	35.0
-2	14.0	1.7	47.6	36.8
-3	13.8	1.7	44.2	40.3
-4	12.0	1.8	57.4	28.8
-5	15.0	2.1	39.4	41.7

TABLE 12

FATTY ACID CONTENT OF OIL FROM ONE-HALF KERNEL OF PEDIGREE MC851^{2}HO BC1

ROW NO.-Ear & Kernel	OIL COMPOSITION (%) PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
094-2.1	9.1	3.3	54.3	31.8
-2.2	8.6	2.9	64.1	24.3
-2.3	7.0	3.2	52.4	36.2
-2.4	8.7	2.7	67.4	20.1
-2.5	15.6	4.2	49.5	32.8
-2.6	11.2	2.9	64.9	20.4
-2.7	9.8	3.1	45.8	39.7
-2.8	10.0	2.9	48.2	38.9
-2.9	9.8	2.5	50.0	36.7
-2.10	8.4	2.7	65.1	22.9
-2.11	9.4	3.1	44.8	42.0
-2.12	8.3	2.4	65.8	21.9
-2.13	7.2	3.1	48.6	40.1
-2.14	6.9	3.2	50.9	39.0
-2.15	7.4	2.8	39.1	50.2
-2.16	6.8	2.6	52.5	37.3
-2.17	12.8	2.5	45.8	37.4
-2.18	6.5	3.0	55.6	33.9
-2.19	11.3	2.5	39.3	46.1
-2.20	11.0	2.4	40.4	46.1
-2.21[1]	5.4	3.5	73.3	16.9
-2.22	6.4	2.5	67.0	22.9
-2.23	11.0	2.5	40.1	46.4
-2.24	9.5	2.9	42.7	43.8
-2.25	7.1	3.1	66.6	22.1
-2.26	7.1	2.9	41.2	47.8
-2.27	8.7	2.9	61.6	25.8
-2.28	9.0	2.8	51.5	36.6
-2.29[1]	8.0	2.7	71.9	16.5
-2.30	7.3	2.8	38.8	49.8
-2.31[1]	5.8	2.4	70.8	20.0
-2.32	6.5	2.7	65.1	25.7
-2.33	6.7	2.8	47.2	42.0
-2.34	11.0	2.8	42.1	43.1
-2.35	9.8	2.5	58.1	28.6
-2.36	10.8	2.9	39.0	46.3
-2.37	9.0	2.5	61.1	26.1
-2.38	7.1	2.7	48.9	41.3
-2.39	12.0	2.6	42.6	41.5
-2.40	7.4	2.6	60.2	29.8
-2.41[1]	5.6	3.5	71.2	18.8
-2.42	11.7	2.3	52.9	32.0
-2.43	9.5	2.7	60.2	26.8
-2.44	10.3	3.5	56.7	28.6

TABLE 12 (cont'd)

ROW NO.-Ear.Kernel	OIL COMPOSITION (%) PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
094-2.45	6.8	3.1	68.2	21.9
-2.46	9.9	2.6	48.2	38.3
-2.47	9.5	2.8	54.7	31.9
-2.48	9.6	2.8	51.7	34.5
-2.49	10.3	3.0	50.0	35.7
-2.50	14.3	2.3	41.5	40.9
-2.51	5.1	2.6	69.5	21.8
-2.52	9.5	2.7	50.7	36.1
-2.53	11.4	2.4	45.2	40.0
-2.54	10.1	2.4	53.9	32.6
-2.55	9.3	2.9	61.1	26.7
-2.56	5.3	2.8	67.6	23.1
-2.57[1]	7.7	2.9	71.2	17.3
-2.58	8.8	2.8	61.1	26.3
-2.59	10.3	2.9	46.5	38.8
-2.60	7.2	2.7	49.3	40.3
-2.61	8.9	2.6	60.2	27.0
-2.62	9.3	2.9	54.4	32.1
-2.63	6.8	3.2	44.2	44.8
-2.64[1]	5.7	3.1	73.2	17.0
-2.65	10.3	2.9	64.4	21.4
-2.66	8.2	2.6	67.2	20.8
-2.67	13.3	2.8	49.9	33.1
-2.68	11.4	2.7	63.4	21.4
-2.69	6.8	3.2	50.1	38.8
-2.70	12.1	2.6	50.8	33.1
-2.71	8.8	2.3	57.1	30.6
-2.72	11.8	2.5	48.3	36.6
-2.73	8.9	2.9	59.6	27.3
-2.74	12.5	3.1	43.3	39.8
-2.75	6.2	2.7	50.3	39.4
-2.76	9.9	2.5	43.8	42.7
-2.77	6.9	2.7	41.0	48.1
-2.78	12.7	2.9	48.2	35.1
-2.79	9.8	3.0	44.7	42.5
-2.80	13.9	2.5	47.4	36.1
-2.81	14.6	2.5	41.6	40.3
-2.82	10.2	2.8	51.3	34.5
-2.83	6.0	2.8	67.6	22.4
-2.84	6.5	2.7	67.1	22.7
-2.85	8.4	2.8	67.8	20.1
-2.86	8.7	2.7	64.9	22.5
-2.87	13.7	2.5	48.4	34.5
-2.88	7.2	3.1	51.8	37.8
-2.89	11.7	2.3	61.7	23.4
-2.90	10.9	2.5	44.3	41.0
-2.91	11.5	2.1	35.3	49.9

TABLE 12 (cont'd)

ROW NO.-Ear.Kernel	OIL COMPOSITION (%) PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
094-2.92	12.6	2.6	45.7	37.8
-2.93	6.5	3.1	50.4	39.1
-2.94	9.0	2.8	52.4	34.7
-2.95	8.9	2.9	63.7	23.1
-2.96	14.0	2.5	38.8	43.5
-2.97	8.2	3.1	66.0	21.6
-2.98	10.2	2.4	47.3	39.0
-2.99	11.1	2.5	40.1	45.2
-2.100	8.5	2.9	68.7	18.8
103-3.4[1]	8.6	2.6	71.7	15.5
-3.9[1]	6.8	3.9	71.8	17.5
-3.62[1]	10.6	2.9	70.1	15.3
-3.67[1]	7.8	3.2	70.0	17.7

EXAMPLE 8

Development of High Oleic Corn Line Using MC75-103 as the Recurrent Parent

In another embodiment to the present invention, one backcross was made to elite parent MC75-103 to incorporate a higher percentage of the elite germplasm characteristics of MC75-103, while retaining the high oleic trait.

High oleic acid corn line 85-205-21 was crossed with MC75-103. MC75-103 is a proprietary line of McCurdy's Seed Company, Fremont, Iowa, and was developed from $B73^2B37$. The background of 85-205-21 is described in Example 2.

The MC75-103 x (85-205-21) cross was backcrossed to the elite MC75-103 line. Five kernel bulk GLC analyses were conducted on individual S1 ears derived from this cross. As shown in Table 13, ear 2 of line 197 has an oleic acid percentage of 65.2%. Table 14 shows data on individual kernels from ear 2. Kernel 10 of ear 2 has an oleic content of 70.5%, while kernels 11 and 15 have oleic acid contents of 72.5% and 71.5%, respectively. All of these values are higher than any previously reported for corn. Kernels identified in Table 14 with a superscript "1" in the first column (row number) are backcrossed to the MC75-103 parent.

High oleic acid inbreds having substantially the same characteristics as MC75-103 are produced in accordance with Example 5. Alternatively, the kernels are further selfed to develop elite lines.

TABLE 13

FATTY ACID CONTENT OF OIL FROM 5 KERNEL BULK OF PEDIGREE MC75-103^{2}HO BC1

ROW NO.-Ear	OIL COMPOSITION (%) PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
197-1	6.8	1.9	52.6	37.1
-2	6.9	1.6	65.2	24.3
-3	10.4	1.7	26.3	60.0
-4	9.3	1.5	49.6	38.0
-5	10.3	1.7	23.7	63.3
198-1	8.6	1.8	23.4	64.6
-2	9.8	1.4	35.4	51.7
-3	8.0	2.1	46.7	41.2
-4	10.6	2.4	34.4	50.9
199-1	10.8	2.0	27.8	57.7
-2	8.5	1.8	33.1	54.8
-3	10.6	2.6	36.6	48.6
-4	10.1	1.6	24.0	62.7
-5	10.2	2.2	31.9	53.9
200-1	10.3	2.0	28.4	57.8
-2	8.6	1.8	47.2	40.6
-3	8.8	2.3	28.7	59.3
-4	9.9	2.5	37.2	49.6
-5	10.1	2.0	31.0	55.9
-6	10.1	2.9	49.0	37.2

TABLE 14

FATTY ACID CONTENT OF OIL FROM ONE-HALF KERNEL OF PEDIGREE MC75-103[2]HO BC1

ROW NO.-Ear.Kernel	OIL COMPOSITION (%) PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
197-2.1	10.4	2.4	44.4	41.4
-2.2	9.4	2.0	36.2	50.9
-2.3	7.8	2.3	45.6	42.7
-2.4	9.7	2.1	51.6	34.9
-2.5	8.5	2.1	51.3	36.2
-2.6	8.9	2.1	34.4	52.6
-2.7	7.4	2.4	50.6	37.5
-2.8	8.9	1.8	53.9	33.1
-2.9	7.1	2.8	54.2	34.2
-2.10[1]	8.3	1.7	70.5	17.9
-2.11[1]	6.7	2.2	72.5	16.8
-2.12	7.6	2.6	54.9	33.3
-2.13	6.8	2.5	47.2	40.6
-2.14	6.5	2.3	68.4	20.5
-2.15[1]	8.3	2.3	71.5	16.2
-2.16	7.5	2.3	37.3	51.4
-2.17	8.9	2.3	48.1	38.9
-2.18	10.3	2.0	46.2	40.0
-2.19	8.3	1.6	40.2	48.4
-2.20	7.2	2.3	47.7	40.9
-2.21	8.0	2.7	44.0	43.7
-2.22[1]	6.1	2.2	72.1	18.4
-2.23	8.6	2.1	29.3	57.9
-2.24	8.2	1.6	34.6	53.8
-2.25[1]	5.5	2.2	74.5	16.4
-2.26	8.0	2.2	47.2	41.0
-2.27	7.4	2.7	54.0	34.3
-2.28	10.2	1.7	36.9	49.5
-2.29	7.8	1.8	36.2	52.8
-2.30	8.4	1.9	41.4	47.0
-2.31	8.1	2.0	37.0	51.2
-2.32	7.3	1.6	64.3	25.1
-2.33	6.4	2.3	35.4	54.2
-2.34	8.9	2.7	48.4	38.4
-2.35	9.5	2.3	36.6	50.0
-2.36	7.2	2.6	37.1	51.1
-2.37	6.1	1.6	65.8	24.6
-2.38	7.1	2.0	62.8	25.5
-2.39	7.4	2.2	37.3	51.5
-2.40	11.0	2.4	36.7	48.0
-2.41	8.0	2.0	65.4	22.7
-2.42	10.2	2.3	46.8	39.1
-2.43	8.6	2.0	50.5	37.3
-2.44	9.6	2.7	43.7	42.0

TABLE 14 (cont'd)

ROW NO.-Ear.Kernel	OIL COMPOSITION (%) PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
197-2.45[1]	6.7	1.9	73.6	16.5
-2.46	10.7	2.0	44.4	41.0
-2.47	8.6	1.8	34.9	52.7
-2.48	6.9	2.4	40.5	48.4
-2.49	9.3	1.9	40.2	46.6
-2.50	8.7	2.0	66.4	21.5
-2.51[1]	7.0	2.3	71.9	16.5
-2.52	9.6	2.4	47.6	38.9
-2.53	9.3	2.6	43.5	43.0
-2.54	8.3	2.5	49.7	37.9
-2.55	7.0	1.7	68.4	21.5
-2.56	8.7	2.1	35.4	52.0
-2.57	9.6	2.6	38.3	47.6
-2.58	7.3	1.5	61.1	28.4
-2.59	8.5	2.7	35.8	51.4
-2.60	7.1	1.5	64.8	25.0
-2.61	7.4	1.9	65.5	23.4
-2.62	8.3	1.8	48.4	39.8
-2.63	9.4	2.2	43.8	43.0
-2.64	9.4	2.2	44.5	42.1
-2.65	6.9	2.3	33.5	55.8
-2.66	7.2	2.3	50.3	38.4
-2.67	8.6	2.5	40.4	46.9
-2.68	8.5	2.6	41.6	44.8
-2.69	8.0	1.5	60.7	27.8
-2.70	6.4	2.3	32.1	57.7
-2.71	7.3	1.7	60.9	28.0
-2.72	8.7	2.2	45.8	41.6
-2.73	8.9	2.5	68.7	18.2
-2.74	6.2	2.0	69.7	20.0
-2.75	7.4	2.1	34.8	55.7
-2.76	8.5	2.5	64.3	22.8
-2.77	7.7	2.0	32.1	56.5
-2.78[1]	7.2	2.4	71.0	17.5
-2.79	6.2	1.8	66.0	24.0
-2.80	9.3	2.2	34.6	52.1
-2.81	8.3	2.6	44.7	42.1
-2.82	7.7	2.4	61.5	28.4
-2.83	8.6	2.4	48.2	39.1
-2.84	8.4	2.1	41.8	45.8
-2.85	10.0	2.2	41.5	44.1
-2.86	8.2	2.1	39.9	47.9
-2.87	8.3	2.7	61.4	25.5
-2.88	6.9	2.1	36.4	52.6
-2.89	10.0	2.4	36.3	49.7
-2.90	7.0	2.1	65.6	23.7

TABLE 14 (cont'd)

ROW NO.-Ear.Kernel	OIL COMPOSITION (%) PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
197-2.91	10.2	2.3	46.7	39.1
-2.92	8.3	2.6	34.8	52.4
-2.93[1]	5.8	1.7	70.2	20.5
-2.94	8.7	2.6	36.0	50.0
-2.95	7.2	2.2	67.4	21.5
-2.96	10.1	2.8	39.1	45.9
-2.97	8.6	2.0	67.0	20.4
-2.98	9.4	1.9	47.8	38.6
-2.99[1]	8.7	2.5	70.8	16.5
-2.100	6.2	2.7	53.7	35.5

EXAMPLE 9

Development of High Oleic Corn Line Using MC74-41 as the Recurrent Parent

In another embodiment of the present invention, one backcross was made to the elite parent MC74-41 to incorporate a higher percentage of the elite germplasm characteristics of MC74-41, while retaining the high oleic trait.

High oleic acid corn line 85-205-21 was crossed with MC74-41. MC74-41 is a proprietary line of McCurdy's Seed Company, Fremont, Iowa, developed from selfing Pioneer Hi-Bred International, Inc.'s 3147 hybrid. The background of 85-205-21 is described in Example 2.

The MC74-41 x (85-205-21) cross was backcrossed to elite line MC74-41. Individual S1 ears derived from this backcross were selected and five kernel bulks from each ear were GLC-assayed as previously described. As shown in Table 15, ear 5 from row 017 had an oleic acid value of 61.2%. Table 16 shows data on individual kernels from ear 5 of row 017. Ear 5, kernel 131 had an oleic acid value of 71.1%. Kernels identified in Table 16 with a superscript "1" in the first column (row

number) are either backcrossed to MC75-103 as described above, or further selfed to produce elite lines.

TABLE 15

FATTY ACID CONTENT OF OIL FROM 5 KERNEL BULK OF PEDIGREE $MC74-41^2HO$ BC1

ROW NO.-Ear	OIL COMPOSITION (%) PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
016-1	11.2	1.8	40.5	46.5
-2	9.0	1.7	41.0	47.5
-3	10.8	1.9	43.8	43.2
-4	12.1	2.0	32.6	52.9
017-1	12.1	2.1	44.4	40.8
-2	11.0	2.3	42.4	44.0
-3	11.3	1.6	47.2	39.6
-4	10.9	1.9	49.6	37.1
-5	10.4	1.3	61.2	27.1
-6	10.1	1.4	54.9	33.1
-7	8.9	1.9	55.0	33.8
-8	12.0	1.8	53.6	32.6
-9	11.0	1.8	51.7	35.6
018-1	13.1	1.9	35.5	49.6
-2	9.9	1.6	51.9	36.1
-3	8.5	1.6	63.2	26.1
-4	9.6	1.9	40.9	46.9
-5	11.7	2.6	39.7	45.4
-6	9.2	3.0	41.5	45.6
019-1	11.2	2.4	39.2	46.6
-2	9.8	2.0	38.1	49.6

TABLE 16

FATTY ACID CONTENT OF OIL FROM 1/2 KERNEL OF PEDIGREE MC74-41^{2}HO BC1

ROW NO.-Ear.Kernel	OIL COMPOSITION (%) PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
017-5-.101	8.1	2.0	42.2	46.8
-.102	10.5	1.3	58.1	28.7
-.103	10.3	1.6	38.8	48.1
-.104	9.6	1.9	60.0	27.0
-.105	10.1	1.9	56.1	29.5
-.106	8.5	2.1	44.2	45.1
-.107	11.6	2.0	45.7	37.7
-.108	11.0	1.7	34.6	51.0
-.109	10.6	1.5	54.6	31.0
-.110	10.1	2.0	46.0	40.7
-.111	12.1	1.7	33.4	51.3
-.112	8.3	1.5	62.9	25.4
-.113	10.3	1.6	45.5	40.8
-.114	11.9	1.6	38.2	46.0
-.115	9.2	1.9	63.1	23.8
-.116	11.4	1.7	37.2	47.9
-.117	9.5	1.9	49.6	37.3
-.118	10.3	1.9	34.4	51.6
-.119	10.5	1.5	45.5	40.9
-.120	11.2	2.0	43.2	42.0
-.121	11.1	1.7	35.4	49.5
-.122	11.6	1.7	49.6	35.2
-.123	13.2	2.4	39.2	45.2
-.124	11.6	1.8	44.7	40.7
-.125	11.4	1.9	38.7	45.6
-.126	10.1	1.6	34.4	52.7
-.127	10.0	1.6	45.6	41.6
-.128	12.1	1.4	41.3	43.8
-.129	9.1	1.3	68.6	19.3
-.130	7.7	2.1	67.7	20.7
-.131[1]	7.2	1.9	71.1	18.6
-.132	12.9	1.6	43.1	40.7
-.133	11.9	1.7	36.3	50.2
-.134	12.0	1.8	33.6	51.3
-.135	8.2	1.7	54.7	33.4
-.136	11.0	1.7	34.9	51.3
-.137	12.2	1.9	34.2	49.2
-.138	10.5	1.6	41.5	45.1
-.139	10.3	1.4	62.4	24.3
-.140	9.3	2.0	39.0	49.7
-.141	13.0	1.4	43.4	42.1
-.142	8.1	1.4	65.3	23.8
-.143	8.9	1.5	57.5	30.4
-.144	8.9	1.8	65.2	22.8

TABLE 16 (cont'd)

ROW NO.-Ear.Kernel	OIL COMPOSITION (%) PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
017-5-.145	9.8	1.9	41.6	44.6
-.146	12.6	1.8	38.3	43.9
-.147	8.4	1.5	64.6	24.2
-.148	11.1	1.7	58.1	27.4
-.149	10.6	1.8	44.0	42.2
-.150	11.1	1.6	43.7	42.2
-.151	8.8	1.6	40.2	47.5
-.152	9.7	2.0	41.4	45.2
-.153	9.9	1.9	44.3	41.5
-.154	11.0	1.8	30.8	53.7
-.155	8.8	2.2	34.4	53.1
-.156	10.8	1.9	45.3	40.7
-.157	10.4	2.1	38.3	47.6
-.158	11.4	2.1	43.8	40.7
-.159	9.5	2.0	47.9	38.5
-.160	10.8	1.8	44.9	40.7
-.161	8.4	1.5	63.0	25.2
-.162	10.5	1.[illegible]	60.0	26.0
-.163	11.2	2.1	44.4	40.0
-.164	9.3	2.0	43.8	43.4
-.165	10.3	2.0	35.9	50.2
-.166	11.6	2.1	43.2	41.1
-.167	12.5	1.6	44.1	39.6
-.168	11.0	1.9	45.4	40.3
-.169	11.5	1.7	45.6	40.1
-.170	10.6	1.8	45.1	40.7
-.171	10.8	2.2	58.1	27.1
-.172	8.2	1.6	59.5	29.2
-.173	9.5	1.8	47.5	39.3
-.174	9.2	1.8	46.1	41.1
-.175	9.8	1.8	62.0	25.2
-.176	10.5	1.7	57.4	28.7
-.177	10.1	1.8	44.1	42.5
-.178	9.4	1.4	62.8	25.3
-.179	8.7	1.8	45.2	42.4
-.180	9.6	1.8	63.6	23.0
-.181	10.2	1.9	42.8	43.1

TABLE 16 (cont'd)

ROW. NO.-Ear.Kernel	OIL COMPOSITION (%) PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
017-5-.182	8.4	1.5	42.7	45.7
-.183	8.7	1.7	46.8	41.7
-.184	9.1	1.9	45.8	41.2
-.185	11.7	2.0	37.2	46.2
-.186	11.1	1.7	50.9	34.1
-.187	7.6	1.5	61.2	28.2
-.188	11.2	1.7	44.6	39.8
-.189	7.1	1.8	64.6	25.4
-.190	11.5	1.9	43.5	41.1
-.191	9.5	1.9	65.0	21.6
018-3.2[1]	7.5	2.1	70.1	18.7
-3.85[1]	6.3	1.8	70.5	20.0
-3.190[1]	7.1	1.7	70.5	18.7
-3.328[1]	7.2	2.1	70.6	18.4
-3.382[1]	7.4	1.9	70.7	18.1

EXAMPLE 10

Development of High Oleic Corn Line Using J17 as the Recurrent Parent

In another embodiment of the present invention, one backcross was made to elite parent J17 to incorporate a higher percentage of the elite germplasm characteristics of J17, while retaining the high oleic acid trait.

High oleic acid corn line 85-205-21 was crossed with J17. J17 is a proprietary line of McCurdy's Seed Company, Fremont, Iowa, developed from C123 x R177. The background of 85-205-21 is described in Example 2.

The J17 x (85-205-21) cross was backcrossed to elite line J17. Individual S1 ears derived from this backcross were selected, and five kernel bulks from each ear were assayed using the GLC method previously described. As shown in Table 17, ear 183 of row 03908752 had an oleic acid value of 58.8%. Table 18 shows data on individual kernels from ear 183 of line 03908752. Kernel 30 of ear 183 had an oleic acid value

of 67.4%. Kernels identified in Table 18 with a superscript "1" in the first column (row number) are either backcrossed to the J17 parent as described above, or further selfed to produce elite lines.

TABLE 17

FATTY ACID CONTENT OF OIL FROM FIVE KERNEL BULK OF PEDIGREE J17²HO BC1

ROW NO.-Ear	OIL COMPOSITION (%) PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
03908752-1	10.2	1.7	27.1	59.6
-2	10.4	1.4	44.1	44.1
-3	10.4	1.8	46.0	41.8
-4	11.7	1.7	35.4	51.2
-5	11.8	1.6	46.9	39.7
-6	10.1	1.6	40.9	47.4
-7	12.0	2.2	32.5	53.3
-8	9.4	2.0	41.4	47.2
-9	9.0	1.9	33.4	55.7
-10	10.7	1.8	42.2	45.2
-11	9.4	1.1	43.2	45.3
-12	11.8	2.1	46.3	39.8
-13	12.1	1.9	31.0	54.9
-14	12.0	2.5	41.7	43.8
-15	8.8	2.7	35.8	52.7
-16	7.9	1.8	57.3	33.0
-17	11.5	2.3	35.3	50.9
-18	8.6	1.3	27.5	62.5
-19	8.0	2.0	29.8	60.1
-20	12.0	1.7	32.6	53.7
-21	11.2	1.3	26.4	61.1
-22	8.8	2.0	36.8	52.4
-23	10.4	1.7	33.6	54.2
-24	9.6	1.8	49.5	39.2
-25	10.9	1.5	45.1	42.5
-26	7.8	1.6	31.2	59.4
-27	9.1	1.9	25.4	63.6
-28	9.6	1.5	36.5	52.4
-29	12.1	2.0	35.4	49.2
-30	11.0	2.2	41.0	45.8
-31	8.9	1.6	55.0	34.5
-32	12.5	1.9	36.1	49.5
-33	12.6	1.6	39.7	46.1
-34	9.6	1.7	29.3	59.3
-35	11.9	1.4	29.1	56.3
-36	11.1	1.7	53.2	34.0
-37	8.7	1.7	41.1	46.9
-38	10.6	1.7	32.2	54.6
-39	10.5	1.6	29.0	58.8
-40	8.3	1.7	41.8	48.2
-41	11.7	1.7	34.5	51.9
-42	10.9	2.7	48.3	38.2
-43	12.1	2.0	27.4	58.5
-44	11.6	1.6	28.2	58.6

TABLE 17 (cont'd)

ROW NO.-Ear	OIL COMPOSITION (%) PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
03908752-45	12.1	1.3	40.0	46.6
-46	10.8	2.0	48.8	38.4
-47	9.2	2.2	54.0	33.6
-48	9.0	1.8	33.4	54.8
-49	9.9	1.8	39.9	46.9
-50	9.5	1.6	31.4	56.3
-51	9.2	1.5	25.9	62.1
-52	11.9	1.8	31.1	53.8
-53	9.2	1.9	35.5	52.3
-54	12.0	1.4	22.0	53.4
-55	11.3	1.4	43.3	42.8
-56	10.0	2.1	42.4	43.7
-57	13.0	1.7	29.5	54.5
-58	9.1	1.2	39.3	49.3
-59	11.4	2.4	37.4	47.7
-60	10.4	1.7	25.8	60.8
-61	11.8	1.2	43.9	42.4
-62	12.3	2.1	41.6	42.9
-63	9.8	1.7	39.7	47.5
-64	8.4	1.4	23.7	65.1
-65	8.6	1.6	28.0	60.2
-66	11.2	1.6	41.4	44.6
-67	8.3	1.5	43.0	46.1
-68	12.8	1.6	28.2	56.1
-69	8.9	2.3	28.7	58.9
-70	11.9	1.6	23.7	60.9
-71	12.8	1.8	34.5	49.5
-72	11.9	1.8	32.0	53.0
-73	13.0	1.6	32.8	51.3
-74	9.8	1.4	47.3	39.9
-75	11.2	1.8	52.3	33.5
-76	12.0	1.6	33.7	51.3
-77	8.9	1.6	62.1	26.0
-78	10.1	1.4	40.7	46.3
-79	12.5	1.3	26.0	58.8
-80	12.1	1.6	46.8	38.2
-81	10.0	1.2	26.4	61.2
-82	10.0	1.6	27.5	59.6
-83	11.6	1.8	29.4	56.2
-84	12.2	1.6	48.2	36.6
-85	10.1	1.3	37.1	49.7
-86	12.8	1.3	32.8	52.3
-87	12.2	1.6	28.3	56.5
-88	11.4	1.8	47.1	38.3
-89	10.6	2.2	48.8	37.3

TABLE 17 (cont'd)

ROW NO.-Ear	OIL COMPOSITION (%) PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
03908752-90	11.3	1.2	51.7	34.2
-91	9.6	1.9	38.0	49.2
-92	12.5	1.7	23.8	60.7
-93	11.2	2.0	35.8	51.0
-94	10.0	1.5	38.9	49.5
-95	8.7	1.7	25.3	64.3
-96	11.0	2.1	53.4	33.6
-97	8.6	1.8	52.4	37.3
-98	11.6	2.0	46.1	40.3
-99	11.6	2.8	38.6	47.0
-100	11.4	2.1	39.3	47.2
-101	13.4	2.1	32.5	51.9
-102	9.8	2.2	36.0	52.0
-103	10.6	2.0	34.1	53.3
-104	6.6	2.3	40.2	51.9
-105	8.8	2.2	31.2	58.8
-106	8.8	1.9	33.6	56.6
-107	10.2	2.3	37.4	50.2
-108	7.7	2.2	45.7	44.4
-109	7.5	1.9	26.8	63.9
-110	9.4	2.1	37.8	50.6
-111	11.3	1.5	25.3	61.8
-112	10.5	2.6	43.7	43.3
-113	8.9	1.5	40.0	49.7
-114	11.1	1.8	47.8	39.3
-115	12.0	1.9	39.3	46.8
-116	11.4	1.7	39.2	47.6
-117	10.0	2.2	33.5	54.3
-118	11.2	2.0	51.3	35.5
-119	11.4	1.9	37.7	49.0
-120	11.3	1.8	34.3	52.6
-121	12.2	2.1	44.3	41.4
-122	10.2	1.8	35.5	52.5
-123	11.2	1.8	24.5	62.5
-124	11.5	1.7	45.0	41.8
-125	10.0	1.6	30.3	58.1
-126	12.0	1.8	37.3	48.9
-127	13.0	1.9	39.9	45.2
-128	12.8	1.9	34.8	50.5
-129	11.9	2.0	43.7	42.4
-130	12.6	1.5	23.8	62.1
-131	8.0	2.2	41.5	48.2
-132	8.0	2.1	36.2	53.6

TABLE 17 (cont'd)

ROW NO.-Ear	OIL COMPOSITION (%) PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
03908752-133	11.7	1.7	28.8	57.8
-134	10.9	1.7	37.9	49.5
-135	10.4	1.7	52.5	35.4
-136	11.4	1.9	28.3	58.4
-137	9.2	1.7	27.0	62.1
-138	9.5	1.8	40.9	47.8
-139	13.0	2.1	38.9	46.0
-140	12.4	2.3	35.3	48.8
-141	9.2	1.6	38.9	48.8
-142	10.0	2.3	37.1	49.4
-143	13.3	2.0	28.2	55.1
-144	11.5	2.3	47.2	37.8
-145	11.3	1.7	30.9	54.7
-146	12.6	1.9	47.2	37.2
-147	11.9	2.1	32.8	52.0
-148	14.5	1.8	30.8	52.0
-149	12.3	1.7	47.7	37.3
-150	11.2	1.9	41.1	44.5
-151	10.8	1.9	34.8	51.1
-152	10.7	2.4	41.8	43.8
-153	10.6	1.3	37.9	48.7
-154	8.6	2.0	32.3	55.8
-155	11.8	1.7	34.4	50.6
-156	9.3	1.6	44.8	43.0
-157	11.9	1.7	47.0	38.0
-158	9.7	1.1	39.3	48.1
-159	10.8	1.7	29.5	56.8
-160	10.1	1.6	38.9	48.0
-161	12.8	1.8	30.0	54.0
-162	12.6	1.6	32.2	52.6
-163	11.9	1.3	42.1	43.2
-164	12.0	1.4	40.1	45.2
-165	13.2	1.8	27.7	56.0
-166	10.6	1.4	31.6	55.0
-167	9.1	1.9	45.8	41.7
-168	12.4	1.2	25.1	59.5
-169	10.1	1.9	30.7	56.0
-170	7.9	2.2	42.4	45.9
-171	9.4	1.5	39.8	48.3
-172	12.7	1.5	27.0	57.2
-173	10.8	2.4	30.2	55.3
-174	12.1	2.2	37.4	47.1
-175	9.5	1.4	32.2	55.3
-176	11.9	1.9	46.3	38.3

TABLE 17 (cont'd)

	OIL COMPOSITION (%)			
	PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
ROW NO.-Ear				
03908752-177	10.5	1.2	40.0	47.0
-178	12.8	1.8	47.4	37.3
-179	12.1	1.5	25.6	58.4
-180	9.4	2.1	34.6	51.3
-181	8.5	1.6	38.3	50.0
-182	8.7	1.3	36.6	50.8
-183	8.3	1.8	58.8	29.7
-184	9.6	1.4	33.6	54.0
-185	11.6	2.1	30.5	54.4
-186	11.8	2.1	40.6	43.8
-187	11.8	2.2	46.4	38.2
-188	11.0	2.2	48.5	36.6
-189	11.0	2.1	32.7	52.7
-190	12.4	1.9	41.8	42.6
-191	11.9	2.0	42.1	42.6
-192	11.7	1.8	36.4	48.7
-193	8.2	1.9	27.7	60.6
-194	9.1	1.7	28.4	59.1
-195	12.6	2.4	31.3	52.2
-196	10.5	1.8	33.7	52.4
-197	11.9	1.8	33.2	51.7
-198	8.7	1.8	49.0	39.1
-199	11.7	1.8	30.6	54.4
-200	12.4	1.5	39.2	45.4
-201	12.2	1.6	30.9	53.7
-202	10.9	2.5	42.7	43.1
-203	12.2	1.7	35.0	49.6
-204	10.7	2.0	32.6	53.2
-205	12.0	2.2	34.1	50.1
-206	13.0	1.7	28.1	55.7
-207	11.5	1.6	28.8	56.5
-208	11.4	1.6	48.4	37.2
-209	11.1	2.0	57.2	28.4
-210	11.1	1.4	26.1	59.7
-211	11.5	1.3	21.5	63.8
-212	9.3	1.6	47.2	40.2
-213	12.2	1.6	34.0	50.6
-214	9.4	2.2	36.8	50.2
-215	8.9	1.5	27.7	60.7
-216	10.6	2.0	43.1	44.3
-217	10.1	1.6	41.8	45.0
-218	10.5	1.7	33.7	52.7
-219	7.6	1.6	29.7	59.4

TABLE 17 (cont'd)

ROW NO.-Ear	OIL COMPOSITION (%) PALM 16:	STEA 18:0	OLEI 18:1	LINO 18:2
03908752-220	11.5	1.5	47.7	37.9
-221	11.4	2.1	32.9	52.2
-222	11.9	2.4	33.9	50.3
-223	12.0	1.8	46.6	38.2
-224	11.8	1.8	39.3	45.7
-225	9.4	1.9	33.9	53.3
-226	11.7	1.8	44.7	40.3
-227	12.2	2.0	34.6	49.7
-228	12.2	1.8	26.1	58.4
-229	12.2	1.8	33.6	51.0
-230	11.6	1.5	33.8	51.7
-231	13.7	2.0	42.0	42.2
-232	13.4	1.6	34.5	49.9
-233	10.2	1.7	40.2	46.4
-234	12.8	1.8	28.7	55.6
-235	11.8	1.5	46.8	38.5
-236	8.9	1.4	43.1	45.4

TABLE 18

FATTY ACID CONTENT OF OIL FROM ONE-HALF KERNEL OF PEDIGREE J17[2]HO BC1

ROW NO.-Ear.Kernel	OIL COMPOSITION (%) PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
03908752-183-.1	9.0	3.1	43.2	44.8
183-.2	9.9	2.4	50.4	37.2
183-.3	7.8	3.2	48.2	38.8
183-.4	7.8	3.3	44.8	42.6
183-.5	10.6	3.0	42.8	41.5
183-.6	8.4	1.9	46.1	43.6
183-.7	8.8	2.2	47.5	41.4
183-.8	6.0	2.6	38.6	52.9
183-.9	6.8	3.1	24.0	62.3
183-.10	6.3	2.5	36.4	54.7
183-.11	10.5	2.3	50.8	36.4
183-.12	10.1	2.1	64.2	22.9
183-.13	6.3	3.0	50.0	40.7
183-.14	8.1	2.8	58.0	31.1
183-.15	9.2	2.3	40.0	48.6
183-.16	6.7	2.4	43.8	47.2
183-.17	10.7	2.1	48.6	38.6
183-.18	7.8	2.1	51.8	38.3
183-.19	8.4	2.6	35.1	54.0
183-.20	6.0	1.9	38.5	52.5
183-.21	8.4	2.0	39.7	49.8
183-.22	8.8	2.6	34.9	52.3
183-.23	6.3	2.8	46.8	41.9
183-.24	7.9	2.5	60.1	24.5
183-.25	8.4	2.3	37.6	50.2
183-.26	8.0	2.1	45.4	43.1
183-.27	8.6	2.8	46.9	40.3
183-.28	8.0	2.5	48.4	39.8
183-.29	9.7	1.7	40.0	47.2
183-.30[1]	5.4	2.8	67.4	23.2
183-.31	5.9	1.9	42.3	48.1
183-.32	8.5	2.5	48.5	38.8
183-.33	6.3	1.7	26.4	64.0
183-.34	5.9	1.6	58.5	32.3
183-.35	5.8	1.6	60.7	30.4

TABLE 18 (cont'd)

ROW NO-Ear.Kernel	PALM 16.0	STEA 18:0	OLEI 18:1	LINO 18:2
	OIL COMPOSITION (%)			
03908752-183-.36	7.8	2.0	41.0	48.6
183-.37	6.2	2.5	38.1	50.8
183-.38[1]	7.9	2.4	65.7	22.3
183-.39	9.4	1.8	33.4	54.0
183-.40	11.1	2.7	41.2	43.7
183-.41	7.7	1.8	38.0	51.2
183-.42	8.6	1.7	41.4	46.5
183-.43	8.5	2.4	60.6	28.5
183-.44	8.4	1.9	36.8	52.8
183-.45	7.4	1.7	60.5	30.4
183-.46	9.0	2.3	40.1	48.6
183-.47	8.5	2.2	44.1	43.8
183-.48	9.0	2.2	62.2	24.5
183-.49	8.9	2.0	48.1	39.6
183-.50	6.8	3.0	51.6	37.3
183-.51	6.4	2.5	48.3	41.3
183-.52	6.1	1.9	60.7	29.1
183-.53	9.7	2.7	49.0	37.5
183-.54	8.0	2.9	48.2	39.5
183-.55	7.1	2.4	50.7	38.3
183-.56	5.9	2.6	35.0	55.1
183-.57[1]	7.1	1.9	65.3	24.0
183-.58	10.0	1.9	37.5	49.1
183-.59	10.5	2.7	42.6	42.9
183-.60	9.2	1.9	44.3	42.6
183-.61	8.5	2.3	47.7	40.3
183-.62	8.2	2.0	35.4	52.9
183-.63	8.2	1.9	46.1	42.4
183-.64	5.6	2.0	49.9	41.0
183-.65	8.8	2.2	34.5	54.6
183-.66	6.2	1.5	35.7	54.6
183-.67	5.8	2.8	30.2	59.8
183-.68	7.5	1.7	59.8	29.8
183-.69	10.1	1.8	48.4	37.2
183-.70	8.6	2.6	62.9	24.4
183-.71	7.6	1.6	39.0	50.3
183-.72	6.0	1.7	53.2	37.6
183-.73	8.6	2.1	32.5	54.3
183-.74	10.7	3.1	43.7	41.6
183-.75[1]	7.4	2.9	67.9	20.0
183-.76	9.5	3.6	39.2	47.7
183-.77	7.7	2.3	45.4	42.8
183-.78	8.2	2.3	36.7	51.1
183-.79	8.7	2.4	39.3	48.4
183-.80[1]	9.0	3.4	66.0	20.1

TABLE 18 (cont'd)

ROW NO.-Ear.Kernel	OIL COMPOSITION (%) PALM 16.0	STEA 18:0	OLEI 18:1	LINO 18:2
03908752-77.63[1]	9.5	2.2	67.2	19.9
-77.66[1]	9.3	2.1	66.0	21.2
-77.67[1]	7.4	2.3	66.0	23.1
-77.78[1]	8.0	2.3	65.3	23.9

EXAMPLE 11
Development of High Oleic Corn Line Using M50-1 as the Recurrent Parent

In another embodiment to the present invention, one backcross was made to elite parent M50-1 to incorporate a higher percentage of the elite germplasm characteristics of M50-1, while retaining the high oleic acid trait.

High oleic acid corn line 85-205-21 was crossed with M50-1. M50-1 is a proprietary line of Jacques Seed Company, Prescott, Wisconsin, developed from [43-118 (43-103-4 x 43-118)]. The background of 85-205-21 is described in Example 2.

The M50-1 x (85-205-21) cross was backcrossed to elite line M50-1. Individual S1 ears derived from this backcross were selected, and five kernel bulks from each ear were assayed using the GLC method previously described. As shown in Table 19, kernel 48 of ear 8 had an oleic acid value of 68.4%, and kernel 53 of ear 2 had an oleic acid value of 68.8%. All kernels shown in Table 19 are either backcrossed to the M50-1 parent as described above or further selfed to produce elite lines.

TABLE 19

FATTY ACID CONTENT OF OIL FROM
ONE-HALF KERNEL OF PEDIGREE M50-1[2]HO BC1

	OIL COMPOSITION (%)			
ROW NO.- Ear.Kernel	PALM 16:0	STEA 18:0	OLEI 18:1	LINO 18:2
01950625-2.8[1]	10.1	3.3	66.9	18.1
-2.11[1]	10.7	2.6	65.7	19.4
-2.53[1]	9.8	2.9	68.8	[illegible]
-2.64[1]	9.7	2.8	66.7	19.4
-2.77[1]	10.5	2.5	65.3	20.8
-2.109[1]	11.4	2.4	66.3	18.6
01950630-8.9[1]	8.8	2.2	66.5	21.1
-8.12[1]	8.5	2.0	67.3	21.0
-8.17[1]	10.2	2.0	66.3	20.6
-8.48[1]	8.5	2.0	68.4	19.9
-8.90[1]	8.6	2.2	66.7	21.0

By following the procedures described in Examples 5-11 and using any commercially acceptable elite corn line, high oleic acid corn lines are obtained having a mean oleic acid content greater than 45%.

EXAMPLE 12

Development of High
Oleic Acid Waxy Corn Lines

Simultaneously with the backcrossing procedures of Examples 5-11, whereby elite endosperm lines are being converted to high oleic acid genotypes, another back-cross procedure is employed to convert MC74-41, PA91, J17, MC731, MC75-103 and MC851 to waxy endosperm geno-types. The latter backcross procedure comprises the following steps: (1) crossing the elite (recurrent) normal endosperm parent to the waxy (donor) parent, yielding F1 seed; (2) backcrossing the F1 to the recurrent parent; (3) growth and self-pollination of the BC1 progeny; and (4) after harvest of the mature seed,

identification of waxy kernels which then become the seed for the next backcross to the normal, recurrent parent (steps two and three above).

Some of the high oleic acid seed from Examples 5-11 are used in backcrossing progeny in which the waxy parents, converted from normal to waxy kernel endosperms by the above procedure, become the recurrent parents. For example, waxy PA91 is used as the recurrent parent in a backcrossing procedure with the high oleic line produced in Example 5. Since only waxy, high oleic seeds are the desired product, a four-fold population size is necessary since the waxy allele is recessive. In other words, only one-fourth of the high oleic recoveries will have waxy endosperms.

Normally three to five backcrosses are sufficient to recover the phenotype of the recurrent parent in a plant that produces waxy kernels.

While the invention has been disclosed in this patent application by reference to the details of preferred embodiments of the invention, it is to be understood that this disclosure is intended in an illustrative rather than in a limiting sense, as it is contemplated that modifications will readily occur to those skilled in the art, within the spirit of the invention and the scope of the appended claims.

WHAT IS CLAIMED IS:

1. A corn seed having an oleic acid content of at least 65% by weight relative to the total fatty acid content of said seed.

2. The corn seed according to claim 1, wherein said oleic acid content is between about 68% and 70% by weight.

3. The corn seed according to claim 1, wherein said oleic acid content is between about 70% and 74% by weight.

4. The corn seed according to claim 1, wherein said oleic acid content is between about 74% and 78% by weight.

5. The corn seed according to claim 1, wherein said oleic acid content is between about 78% and 82% by weight.

6. The corn seed according to claim 1, wherein said oleic acid content is greater than about 82% by weight.

7. A corn plant that produces seeds having a mean oleic acid content of at least 55% by weight relative to the total fatty acid content of said seeds.

8. The corn plant according to claim 7, wherein said plant displays a waxy phenotype.

9. The corn plant according to claim 7, wherein said plant displays an amylose extender phenotype.

10. The corn plant according to claim 7, wherein said plant displays a GA1-S (super gametophyte factor) phenotype.

11. The corn plant according to claim 7, wherein said plant is a hybrid.

12. The corn plant according to claim 11, wherein said hybrid displays a waxy phenotype.

13. The corn plant according to claim 11, wherein said hybrid displays an amylose extender genotype.

14. The corn plant according to claim 11, wherein said hybrid displays a Ga1-S (super gametophyte factor) genotype.

15. The corn plant according to claim 7, wherein said mean oleic acid content is between about 55% and 60% by weight.

16. The corn plant according to claim 15, wherein said plant is a hybrid.

17. The corn plant according to claim 7, wherein said mean oleic acid content is between about 60% and 65% by weight.

18. The corn plant according to claim 17, wherein said plant is a hybrid.

19. The corn plant according to claim 7, wherein at least some of said seeds, when germinated, grow into plants that also produce seeds having a mean oleic acid content of at least 55% by weight relative to the total fatty acid content of said seeds.

20. A corn plant that produces seeds having a mean oleic acid content of at least 65% by weight relative to the total fatty acid content of said seeds.

21. The corn plant according to claim 20, wherein said plant is a hybrid.

22. The corn plant according to claim 20, wherein said mean oleic acid content is between about 70% and 75% by weight.

23. The corn plant according to claim 22, wherein said plant is a hybrid.

24. The corn plant according to claim 20, wherein said mean oleic acid content is between about 75% and 80% by weight.

25. The corn plant according to claim 24, wherein said plant is a hybrid.

26. The corn plant according to claim 20, wherein said mean oleic acid content is greater than about 80% by weight.

27. The corn plant according to claim 26, wherein said plant is a hybrid.

28. A corn variety characterized by kernel bulks having a mean oleic acid content of at least 55% by weight relative to the total fatty acid content of said seeds.

29. A corn variety characterized by seeds that have an oleic acid content of at least 55% relative to the

total fatty acid content of the seeds, said variety being true breeding for said oleic acid content.

30. The corn variety according to claim 29, wherein said mean oleic acid content is between about 55% and 60% by weight.

31. The corn variety according to claim 29, wherein said mean oleic acid content is between about 60% and 65% by weight.

32. A corn variety characterized by kernel bulks having a mean oleic acid content of at least 65% by weight relative to the total fatty acid content of said seeds.

33. The corn variety according to claim 32, wherein said mean oleic acid content is between about 65% and 70% by weight.

34. The corn variety according to claim 32, wherein said mean oleic acid content is between about 70% and 75% by weight.

35. The corn variety according to claim 32, wherein said mean oleic acid content is between about 75% and 80% by weight.

36. The corn variety according to claim 32, wherein said mean oleic acid content is greater than 80% by weight.

37. The corn variety according to claim 29, wherein said variety is a waxy variety.

38. The corn variety according to claim 29, wherein said variety exhibits an amylose extender genotype.

39. The corn variety according to claim 29, wherein said variety exhibits a Ga1-S (super gametophyte factor) genotype.

40. A corn variety characterized by single seeds that have an oleic acid content of at least 65% relative to the total fatty acid content of said seeds.

41. The corn variety according to claim 40, wherein said variety is true-breeding for a high oleic acid phenotype.

42. The corn variety according to claim 41, wherein said mean oleic acid content is between about 68% and 70% by weight.

43. The corn variety according to claim 41, wherein said mean oleic acid content is between about 70% and 74% by weight.

44. The corn variety according to claim 41, wherein said mean oleic acid content is between about 74% and 78% by weight.

45. The corn variety according to claim 41, wherein said mean oleic acid content is between about 78% and 82% by weight.

46. The corn var ty according to claim 41, wherein said mean ole c acid content is greater than 82% by weight.

47. The corn variety according to claim 41, wherein said variety is a waxy variety.

48. The corn variety according to claim 41, wherein said variety comprises an amylose extender genotype.

49. The corn variety according to claim 41, wherein said variety comprises a Ga1-S (super gametophyte factor) genotype.

50. A _Zea mays_ L. seed product consisting of a substantially homogeneous assemblage of corn seeds which has a mean oleic acid content of at least 55% by weight relative to the total fatty acid content of said seeds.

51. The seed product according to claim 50, wherein said mean oleic acid content is between about 55% and 60% by weight.

52. The seed product according to claim 50, wherein said mean oleic acid content is between about 60% and 65% by weight.

53. A _Zea mays_ L. seed product consisting of a substantially homogeneous assemblage of corn seeds which has a mean oleic acid content of at least 65% by weight relative to the total fatty acid content of said seeds.

54. The seed product according to claim 53, wherein said mean oleic acid content is between about 70% and 75% by weight.

55. The seed product according to claim 53, wherein said mean oleic acid content is between about 75% and 80% by weight.

56. The seed product according to claim 53, wherein said mean oleic acid content is greater than 80% by weight.

57. A commercially acceptable corn variety characterized by kernel bulks having a mean oleic acid content of at least 45% by weight relative to the total fatty acid content of said seeds.

58. The corn variety according to claim 57, wherein said mean oleic acid content is between about 45% and 50% by weight.

59. The corn variety according to claim 57, wherein said mean oleic acid content is between about 50% and 55% by weight.

60. A commercially acceptable corn variety characterized by kernel bulks having a mean oleic acid content of at least 55% by weight relative to the total fatty acid content of said seeds.

61. The corn variety according to claim 60, wherein said mean oleic acid content is between about 60% and 65% by weight.

62. A commercially acceptable corn variety characterized by kernel bulks having a mean oleic acid content of at least 65% by weight relative to the total fatty acid content of said seeds.

63. The corn variety according to claim 62, wherein said mean oleic acid content is between about 70% and 75% by weight.

64. The corn variety according to claim 62, wherein said mean oleic acid content is between about 75% and 80% by weight.

65. The corn variety according to claim 62, wherein said mean oleic acid content is greater than about 80% by weight.

66. A commercially acceptable corn hybrid plant characterized by kernel bulks having a mean oleic acid content of at least 45% by weight relative to the total fatty acid content of said seed.

67. The corn hybrid plant according to claim 66, wherein said mean oleic acid content is between about 45% and 50% by weight.

68. The corn hybrid plant according to claim 66, wherein said mean oleic acid content is between about 50% and 55% by weight.

69. A commercially acceptable corn hybrid plant characterized by kernel bulks having a mean oleic acid content of at least 55% by weight relative to the total fatty acid content of said seed.

70. The corn hybrid plant according to claim 69, wherein said mean oleic acid content is between about 60% and 65% by weight.

71. A commercially acceptable corn hybrid plant characterized by kernel bulks having a mean oleic acid content of at least 65% by weight relative to the total fatty acid content of said seed.

72. The corn hybrid plant according to claim 71, wherein said mean oleic acid content is between about 70% and 75% by weight.

73. The corn hybrid plant according to claim 71, wherein said mean oleic acid content is between about 75% and 80% by weight.

74. The corn hybrid plant according to claim 71, wherein said mean oleic acid content is greater than about 80% by weight.

75. A commercially acceptable hybrid corn plant having an oleic acid content of at least 65% by weight relative to the total fatty acid content of said seed, said seed being the product of cross between (A) a first parent from a corn variety that is true breeding for said oleic acid content and (B) a second parent from a second corn variety.

76. A hybrid corn plant according to claim 75, wherein said second corn variety is true breeding for said oleic acid content.

77. A corn oil having a mean oleic acid content of at least 55% relative to the total oil which has been extracted from a substantially homogeneous assemblage of corn seeds having a mean oleic acid content of at least 55% by weight relative to the total fatty acid content of said seeds.

78. The corn oil according to claim 77, wherein the mean oleic acid content is between 55% and 60%.

79. The corn oil according to claim 77, wherein the mean oleic acid content is between 60% and 65%.

80. A corn oil having a mean oleic acid content of at least 65% relative to the total oil which has been extracted from a substantially homogeneous assemblage of corn seeds having a mean oleic acid content of at least 65% by weight relative to the total fatty acid content of said seeds.

81. The corn oil according to claim 80, wherein the mean oleic acid content is between 70% and 75%.

82. The corn oil according to claim 80, wherein the mean oleic acid content is between 75% and 80%.

83. The corn oil according to claim 80, wherein the mean oleic acid content is greater than about 82%.

84. A method for producing high oleic acid corn material, comprising the steps of:

(A) obtaining a plurality of corn seeds having a mean oleic acid content of at least about 45% to about 59%;

(B) growing out said plurality of corn seeds to obtain a population of corn plants;

(C) intermating plants comprising said population to produce first seeds;

(D) subjecting said first seeds to selection based on oleic acid content, such that a predetermined upper percentage of said first seeds, relative to oleic acid content, is retained and plants grown from said upper percentage of seeds are intermated to produce second seeds;

(E) with said second seeds obtained, repeating steps (B), (C) and (D) at least once, whereby plants producing seeds that have a mean oleic value of at least 55% by weight are obtained.

85. A method according to claim 84, wherein said upper percentage of seeds is about 10%.

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 91/04626

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl.5 A 01 H 1/02 A 01 H 5/10

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl.5	A 01 H

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
X	Journal Agricultural Food Chem., volume 18, no. 3, 1970, M.D. Jellum: "Plant introductions of maize as a source of oil with unusual fatty acid composition", pages 365-370, see page 368, right-hand column, line 1 - page 369, righ -hand column, line 5; taie IV (cited in the application)	7,11,17 -19,28, 50,52, 57,60, 61,66,
		69,70, 77,79
A		1,8-10, 12-16, 20-27, 29-36, 40-46, 51,
	-/-	

° Special categories of cited documents : [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
25-11-1991	09. 01. 92

International Searching Authority	Signature of Authorized Officer
EUROPEAN PATENT OFFICE	Danielle van der Haas

Form PCT/ISA/210 (second sheet) (January 1985)

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
		53-56, 58,59, 62-65, 67,68, 71-76, 78,
		80-82, 84

X	CAB Abstracts 0516471 OP046-11070, E.J. Weber et al.: "Breeding for lipid composition in corn", & Journal of the American Oil Chemists' Society, 1975, 52(9): 370-373, see the wole article	7,11,15 -19,28-31,50-52,57-61,66-70,
		77-79
A		84

Y	Kirk-Othmer: "Encyclopedia of chemical technology", 1980, John Wiley & Sons, (New York, US), volume 9, chapter "Fats and Fatty oils", pages 795-831, see tables 1-3	1-7,11, 15-36, 40-46, 50-83

Y	Crop Science, volume 24, 1984, N.W. Widstrom et al.: "Chromosomal location of genes controlling oleic and linoleic acid composition in the germ oil of two maize inbreds", pages 1113-1115, see the whole document (cited in the application)	1-7,11, 15-36, 40-46, 50-83

X	R.W. Allard: "Principles of plantbreeding", 1960, John Wiley & Sons, (New York, US) Chapter 16 "Responses to selection and the genetic oganisation of populations", pages 182-196; chapter 21 "Selection in cross-pollinated crops", pages 252-262; chapter 23, "Recurrent selection", pages 282-302, see page 184, line 1 - page 189, line 10; figures 16.1-16.4; page 258, line 19 - page 260, line 23	84,85

A	N.W. Simmonds: "Principles of crop improvement", 1979, Longman (London, GB) Chapter 5 "Breeding plans", paragraphs 5.4 and 5.5, pages 135-161, see the whole document	84

-/-

International Application No PCT/US 91/04626

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	US,A,4627192 (FICK) 9 Decembe .986, see column 1, line 1 - column -, line 11; tables 2,3 ---	77-85
A	WO,A,9000856 (DNA PLANT TECHNOLOGY CORPORATION) 8 February 1990, see page 21, line 14 - page 23, line 5 ---	84,85
A	EP,A,0323753 (ALLELIX INC.) 12 July 1989 ---	
A	FR,A,2617675 (UNIVERSITY OF FLORIDA) 13 January 1989 -----	

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. US 9104626 SA 50283

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 17/12/91 The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 4627192	09-12-86	US-A- 4743402	10-05-88
WO-A- 9000856	08-02-90	None	
EP-A- 0323753	12-07-89	None	
FR-A- 2617675	13-01-89	JP-A- 1091720	11-04-89

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82